THURSDAY, AUGUST 6, 1914.

THE NEW BRITISH FLORA.

The Cambridge British Flora. By Dr. C. E. Moss. Illustrated from drawings by E. W. Hunnybun. Vol. ii., Salicaceæ to Chenopodiaceæ. Pp. 206+206 plates. (Cambridge: University Press, 1914.) Price 2*l.* 10*s.* net.

THERE can be no difference of opinion as to the need for a new, comprehensive, and authoritative British flora. Our knowledge of British plants has increased and broadened to an extent which renders the "English Botany" quite inadequate for critical work. Sir J. E. Smith's "English Botany," with the admirable illustrations by James Sowerby, goes back to the early years of last century; and the third edition, with its much inferior illustrations, is, from the point of view of the modern worker, almost equally out of date. One of the most important changes which has influenced British botany during the last half-century is the comparative study of our flora and that of other European countries. Prof. C. C. Babington was one of the first to appreciate the importance of this relation, and his manual, now in its ninth edition, is still regarded as the most critical presentation of the botany of the British Isles. It is appropriate that Babington's successor in charge of the Cambridge Herbarium, and the Cambridge University Press, should be jointly responsible for a comprehensive and up-to-date presentment of the same subject.

It goes without saying that Dr. Moss has entered upon a difficult piece of work. The treatment adopted, as illustrated by the one volume which has already appeared, shows that the work is to be no mere compilation, but that it will record the results of a thorough critical study of each group. The full meaning of this will be realised only by those who have followed the detailed study of the flora of north and central Europe, of which our own forms a part, during the past few decades. Dr. Moss has special qualifications for this work, but to bring such an undertaking to a satisfactory completion within reasonable time is more than one man's task, and we are glad to note that Dr. Moss has promise of help from various botanists who have made a speciality of certain groups. We trust that he will make use to the fullest extent possible of this expert assistance.

The plan of the book is fully explained in the introduction. The systematic arrangement of the groups is that of Engler's "Syllabus," an arrangement which is now in general use on the continent of Europe and also in America. Following the recommendations of the International "Rules of Nomenclature," Dr. Moss uses the term "family" in place of "natural order," while the "order" is a group of higher rank—an aggregate of families. Except in a few minor points, Dr. Moss follows the "Rules," to a discussion of which he devotes several pages. He does not, however, fully appreciate the advantage of rules, namely, that you follow them, but sometimes goes out of his way to assert an individuality in matters of trifling importance. Short but adequate descriptions are given of the orders, families, and genera; those of the species are generally longer, the length varying with the needs of the case; under the species the different varieties and forms are sufficiently described; subspecies are not recognised. Synonymy, references to published figures and exsiccata are quoted in so far as these are helpful to the student of British plants; and the distribution in the British Isles and also the general distribution are given. British distribution is in many cases illustrated by outline maps. In his concept of species Dr. Moss has steered a middle course between the larger view as typified by Bentham's work and the *petit espèce* of the French botanist, Jordan.

In the present volume (vol. ii.) the earlier orders of Dicotyledons are treated, comprising the catkin-bearing families, which, with Ulmaceæ, Cannabaceæ, and Urticaceæ, form the subclass Amentifloræ, Santalaceæ, Loranthaceæ, Aristolochiaceæ, and Polygonaceæ, forming the subclass Petaloideæ, and Aizoaceæ, Amarantaceæ and Chenopodiaceæ, forming a portion of the subclass Centrospermæ. As this list indicates, plants are included which, though not indigenous, are more or less definitely naturalised, such as *Mesembryanthemum edule* (Aizoaceæ), a native of the southern hemisphere, and the American *Amarantus retroflexus*. The accurate recording of the occurrence of plants of this category is of special interest with a view to their future behaviour as items of our flora. The genus Betula has been elaborated by the Rev. E. S. Marshall, and in the family Chenopodiaceæ Dr. Moss has had the assistance of Mr. A. J. Wilmott (Atriplex), Mr. C. E. Salmon (Salsola), and Dr. E. J. Salisbury (Salicornia).

The text is very clearly printed, and the contrast of type is well-selected and helpful. A little more space might with advantage have been allowed between each family, and the typographical subordination of the genus-name is somewhat disconcerting until one gets used to it; but the general effect is dignified. A good portrait of John Ray forms a fitting frontispiece.

A A

The plates are a special feature of the work. The generous gift to the university by Mr. Hunnybun of his series of pen-and-ink drawings of British flowering plants was, we believe, the immediate cause of its inception. A characteristic is that each drawing is made from an individual plant in the fresh state—no attempt has been made to give an abstract idea of the form, variety, or species figured. The drawings have been reproduced by photography and are remarkably clear, and sometimes very delicate representations of the whole or part of the plant; the details of floral structure are, however, often too small or incomplete. The wealth of illustration may be judged from the fact that the present volume contains no fewer than 206 plates.

The work is to be completed in about ten volumes, which, so far as is practicable, will be issued annually; each volume may be had in two parts, text and plates respectively, or, at a somewhat higher price, in one part, with the plates mounted on guards and interspersed with the text. Vol. i. has been set apart for conifers and ferns, and mosses, hepatics, and charas may also be included. A. B. R.

GEOGRAPHICAL GUIDES.

(1) *Junk's Natur-Führer. Die Riviera.* By Alban Voigt. Pp. vi+466+vi plates. (Berlin: W. Junk, 1914.) Price 7 marks.

(2) *Einführung in die Erdbeben- und Vulkankunde Süditaliens.* By August Sieberg. Pp. vi+226. (Jena: Gustav Fischer, 1914.) Price 4 marks.

(3) *Cambridge County Geographies. Merionethshire.* By A. Morris. Pp. ix+166+2 maps. *Northumberland.* By S. Rennie Haselhurst. Pp. xi+181+2 maps. (Cambridge University Press, 1913.) Price 1*s.* 6*d.* each.

(4) *The Madras Presidency. With Mysore, Coorg, and the Associated States.* By E. Thurston. Pp. xii+293. (Cambridge University Press, 1913.) Price 3*s.* net.

(1) THE first of Junk's Natur-Führer, Dalla Torre's volume devoted to Tirol, was reviewed in this journal in December, 1913 (vol. xcii., p. 471). Alban Voigt's treatment of the Riviera differs entirely from the method adopted by his predecessor. In Tirol we were given minute references to the objects of interest along roads and footpaths, so that the scientific traveller alighting at an inn might look round before dinner for rare birds or for the traces of historic earthquakes. The guide-book to the Riviera is almost entirely devoted to a comprehensive review of the plant-life of the country, and the index contains plant-names only. Due stress is laid (p. 284) on Sir Thomas Hanbury's garden at La Mortola, a hamlet between Ventimiglia and Mentone, and 135 pages are occupied with an account of the cultivated plants, though these are not native to La Mortola. The geology of the district is treated in fifteen pages, and twelve more are given to the famous prehistoric caves of Mentone. It is clear that the greater part of this "guide-book" will be quite as useful in the library as in the field, and the description of the native flora in relation to its environment makes an appeal to every modern botanist. As examples of the author's historical method, we may mention the disquisition on *Ferula nodiflora*, the source, according to Martial, of scholastic "ferules" (p. 123), and the account of the recent immigration of *Lepidium draba* (p. 211), a steppe-plant that, like the Huns, has followed the Danube and then descended into Roman territory. The appearance of this book in Junk's series may herald further surprises. Will the promised Swiss volume prove to be an authoritative work on mountain-structure?

(2) The visitor in Italy cannot fail to become interested in volcanoes, and A. Sieberg's review of the volcanic and earth-shaken areas might well be translated into several languages. The author is on the staff of the seismological institute at Strassburg. He shows clearly how the volcanic zone is connected with the folded structure of Italy as a whole, and with the fractured and sunken basin that is now flooded by the Tyrrhenian Sea. The review of the recent history of Vesuvius is exactly what the intelligent visitor requires, and the form of the mountain is shown to depend on a series of events going back to the building of Monte Somma, which is the "first phase" indicated by Johnston-Lavis. F. A. Perret's beautiful photographs are used for many of the illustrations, and those of eruptions on Etna are especially welcome. The author's own pictures are admirable, though he has, with unusual self-denial, converted some of them into diagrams. Personal observations, such as those on the polygonal soil formed by moving ash (p. 155), add to the interest throughout a very readable book. The Æolian Islands are effectively included; J. W. Judd's papers, published in the *Geological Magazine* about 1876, should be mentioned in the useful bibliography. While accepting steam as a constituent of lava-flows, the author wisely refrains from dogmatising as to the gases of paroxysmic outbursts.

(3) The Cambridge County Geographies are continued with Merionethshire and Northumberland. Their only defect is that no single author can deal equally with the geological basis, with

the topography, with the antiquities, and with the "roll of honour." Mr. Morris, for example, assigns the magnificent examples of igneous sills, lava-flows, and tuffs, that contribute so much to the scenery of Merionethshire, to the Archæan era. The great scarp of Cader Idris, appropriately figured, is ascribed to ash. The memoir of the Geological Survey on North Wales would have supplied accurate information. The wealth of historic features in the county is well illustrated; the noble roadways are properly extolled; and the charmingly printed landscapes should send many a visitor southward from the better-known district of Snowdonia.

In Northumberland Mr. Haselhurst has a still more attractive field. We turn with equal pleasure to his descriptions of Bamburgh, the superb valley of the Tyne, and the Roman Wall, "as much a road as a wall," as he well remarks. For us, Northumberland centres in Hexham, within shelter of the Wall, and the land beyond seems wild and Pictish. Others, however, will prefer Rothbury or Alnwick; and it is hard to remember that the rich lands from Coldstream to Berwick are part of the border country, equally with Cheviot and Carter Fell. Northumberland has preserved much of its ancient character; the women workers in the fields (p. 71), who are so noticeable to the stranger, may be a tradition from a time when every man was employed in arms. The smoke of Newcastle is merely a displeasing local episode in a county that includes Corstopitum and "the strength and help of Joyous Gard."

(4) The Cambridge University Press has placed a series of "Provincial Geographies of India" under the editorship of Sir T. H. Holland, which is in itself a sufficient guarantee. The mode of production and the illustrations are in every way worthy of the publishers, and make the low price seem more surprising. A feature of our age which too often passes unnoticed is that the cost of good books has steadily gone down. Such a volume as this on Madras should be in the library, not only of geographers, but of teachers of imperial history. Anthropological details are abundant, and a tale of the suspension of two dacoits in iron cages, apparently under British rule, finds its way somehow into a chapter on mountains, while the demon Biraiya figures in that on rivers. The author has the power of sustaining interest; he knows the country and the people, and we are glad to know them in his company. The quaint *Ostracion cornutus* (p. 33), the fish that was once a cow, until its grazing-ground was converted into an island, shows how legends may record actual earth-changes. Mr. Thurston has the invaluable gift of sympathy, which makes him write of "the delightful group of baby elephants" in a seventh-century bas-relief, and allows him to touch on native customs without a trace of the old-time condescension. The modesty of the editor, to whom the term charnockite is due, may account for the absence of any explanation of the special characters of this rock (p. 57).

G. A. J. C.

GENETICS.

(1) *Elemente der Exakten Erblichkeitslehre mit Grundzügen Biologischen Variationsstatistik.* By Prof. W. Johannsen. Zweite Deutsche Ausgabe in 30 Vorlesungen. Pp. xi+723. (Jena: Gustav Fischer, 1913.) Price 13 marks.

(2) *Selektionsprinzip und Probleme der Artbildung.* Ein Handbuch des Darwinismus. By Prof. Ludwig Plate. Vierte Auflage. Pp. xv+650. (Leipzig and Berlin: W. Engelmann, 1913.) Price 16 marks.

(3) *Einführung in die Vererbungswissenschaft.* By Prof. R. Goldschmidt. Zweite Auflage. Pp. xii+546. (Leipzig and Berlin: W. Engelmann, 1913.) Price 13 marks.

(4) *The Meaning of Evolution.* By Prof. S. C. Schmucker. Pp. 298. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1913.) Price 6*s.* 6*d.* net.

THE great interest taken at the present time in the subjects included under the comprehensive term "genetics" is illustrated by the fact that second or later editions of three standard works in German on the subject, each consisting of more than 500 pages, were published in 1913. It is inevitable that books of this kind should overlap to some extent, but they do so much less than their titles might lead one to expect. That they are so different is due partly to the great extent of the subject, which makes it possible for books to deal with different sides of it without encroaching on one another to any great extent, and partly to the wide differences of opinion which still exist, resulting in very different treatment of similar classes of facts.

(1) The first German edition of Johannsen's "Elemente der exakten Erblichkeitslehre" (1909) was reviewed in NATURE of October 7, 1909, before the author's work on inheritance in "pure lines" had received the widespread recognition which has since been accorded to it. The book is now generally known to students of heredity, and our account need only describe the changes in the second edition. It has been enlarged from twenty-five to thirty lectures (from 515 to 723 pages), and as the illustrations are confined to a few diagrams, it has become a very big book. New chapters

have been added on inheritance in pure lines, and on the effects of environment, besides a large amount of new matter in the old chapters. A considerable part of the added matter refers to the more recent developments of Mendelian work; four lectures on this subject are almost entirely new, and include discussions of such matters as sex-limited inheritance and sex-determination, genetic coupling and repulsion, sterility, etc. Papers published during 1913 are referred to, but although up-to-date, the book is far more than a mere compilation, it rather presents the author's view of the subject illustrated by examples chosen from the work of many investigators. It is, of course, impossible that in so large a book, dealing with matters which are still the subject of controversy, there should not be much with which many readers will disagree. But of the book as a whole our chief criticism is that it is too long; although one could ill spare the many half-humorous touches which reveal the author's kindly personality and enthusiasm, yet 700 pages of closely printed German are more than the majority of us have time to read. As a book of reference it should be accessible to every student, but it is written to be read, rather than referred to.

(2) The third edition of Plate's "Selektionsprinzip und Probleme der Artbildung" has also been reviewed in NATURE (October 15, 1908), so that in this case also only the changes introduced in the fourth edition need be referred to. As mentioned in the preface, the chief alteration is the omission of the section on alternative inheritance, since this is dealt with in the author's "Vererbungslehre mit besonderer Berücksichtigung des Menschen" (reviewed in NATURE, May 22, 1913). This omission is counterbalanced by a great enlargement of the chapter on inheritance of acquired characters, so that the total size of the book is increased by more than 150 pages and many figures. This enlargement is due, to a considerable extent, to a full account of the experiments of Kammerer and others, which have been published since the previous edition was issued. The author's general attitude is illustrated by his statement in the preface that "de Vries has misrepresented the views of Darwin, and that his mutations are identical with Darwin's individual variations"; and "dass nur Lamarckismus und Selektionismus zusammen die Entstehung der Anpassungen und der Arten verständlich machen." The book is very valuable as a summary, but appears to us insufficiently critical in the case of some of the examples cited.

(3) Goldschmidt's "Einführung in die Vererbungs Wissenschaft" (second edition) belongs to a somewhat different category. It consists of twenty-two lectures, and is based, as the preface tells us, on the author's university course on the subject. It has the merits and defects of this kind of treatment; that is to say, its title correctly describes it as an introduction to, rather than a treatise on, genetics. It is expository rather than critical, and in places leaves an unsatisfactory sense of not getting to the bottom of the subject. It covers a wide range of subjects, is well illustrated, has a useful bibliography, and throughout contains much valuable matter. This is especially the case where it deals with the author's special branch of the subject, the inheritance of secondary sexual characters. In particular, the author's hypothesis of varying "potency" of the factors for secondary sexual characters, and of the sex-factors themselves, is perhaps the most interesting section of the book (lecture xviii.). He considers that in certain circumstances a zygote which contains factors which would normally produce one sex may develop into a hermaphrodite, or even an individual of the other sex in consequence of "Potenzverschiebung" of the sex-factors. Lack of space prevents our giving an adequate account of the hypothesis, which may have important bearing on the theory of sex-determination. In places the book conveys the impression of haste, and it would perhaps be improved if fewer examples were described, and these treated more fully.

(4) Prof. Schmucker's "Meaning of Evolution" belongs to quite a different class. It is a popular book on the general principles of the evolution theory, and makes no claim to be an original contribution to the subject. One of its objects is to show that there is no necessary inconsistency between a belief in organic evolution and religion. It is in general pleasantly written, but does not differ conspicuously from other books of the same type.

OUR BOOKSHELF.

A Descriptive Catalogue of the Marine Reptiles of the Oxford Clay. Based on the Leeds Collection in the British Museum (Natural History). Part ii. By Dr. C. W. Andrews. Pp. xxiv + 206 + xiii plates. (London: British Museum (Natural History). Longmans, Green and Co., 1913.) Price 25*s*.

THE scientific value of the remains obtained by Messrs. Leeds from the Oxford Clay near Peterborough is exemplified by the groups forming the subject of the present, and concluding, volume of this excellent and exhaustive catalogue. In order to realise this, a visit is almost essential to the Natural History Museum, where a mounted skeleton of the pliosaurian Peloneustes will come as a revelation to those unacquainted with the state of

preservation of many items in the Leeds collection.

At the epoch of the Oxford Clay pliosaurs (together with their cousins the elasmosaurs) and the marine crocodiles of the families Teleosauridæ and Geosauridæ were at the zenith of their development, and therefore too advanced to afford clues to the relationships and origin of the order to which they pertain. Nevertheless, the point is not passed over by Dr. Andrews, who, after rejecting the theory of an affinity between plesiosaurs and pliosaurs on the one hand and tortoises and turtles on the other, supports the opinion that the two former are descended from the carnivorous mammal-like reptiles of the Permian and Trias. As regards Oxfordian crocodiles, the author merely affirms that while the steneosaurs (Teleosauridæ) are derived from the mystriosaurs of the Lias, the species of Metriorhynchus (Geosauridæ), on account of differences in the structure of the base of the skull, had a different origin.

As the Oxfordian crocodiles appear to have been more aquatic than any existing members of their order, while the contemporary ichthyosaurs, elasmosaurs, and pliosaurs were completely so, the Jurassic seas must have swarmed with a medley of reptilian forms of life, in striking contrast to the more uniform type presented by their cetacean supplanters of to-day. With their large heads and short necks, the Oxfordian plesiosaurs appear to have been better adapted to a pelagic existence than the contemporary elasmosaurians; and it is of interest to note that in respect of food they appear to have presented a parallelism to cetaceans, some having subsisted on cephalopods, while others attacked and devoured larger and more formidable prey. R. L.

The Future of Education. By F. C. C. Egerton. Pp. 303. (London: G. Bell and Sons, Ltd., 1914.) Price 3*s.* 6*d.* net.

THIS is a book provocative of serious thought in these days of educational misgiving and unrest. The author raises a strong indictment against present educational aims and methods, and adduces in support of his contentions some extraordinary incidents which have come within his immediate experience.

Especially is he wroth with our system of elementary education, and declares with emphasis:—"There is only one word that adequately describes the state of education in this country, and that is 'chaos,'" and further remarks that "as a system it is absolutely rotten from beginning to end," and that "what is said with regard to the elementary school applies with nearly equal force to the secondary school—the same narrowness of outlook, the same lack of adjustment to the requirements of life, the same unreality and artificiality characterises both types of schools."

He declares that "our organisation is entirely disjointed. Each elementary school is conducted haphazard, each secondary school is a law unto itself, and the public schools and universities go their own way, good or bad." The only comfort we receive is in the fact that "it is quite true that other countries stand in exactly the same position."

Much stress is properly laid upon the importance of the elementary school, public and private, through which ninety-five out of every hundred men and women pass. "It is the hope of the country, and it has in its power to lay the foundations of many noble lives." The writer condemns formal and disciplinary methods of education, and directs strong attention to Montessorian aims and methods, and the need for the child to be allowed fully to realise itself. In spite of some extravagance of statement, the book is well worthy of serious study. J. H. R.

Coast Sand Dunes, Sand Spits and Sand Wastes. By G. O. Case. Pp. xi+162. (London: St. Bride's Press, Ltd., 1914.) Price 5*s.* net.

THE object of this book, as stated by the author in the preface, is to direct attention to the advantage of controlling the blown sand dunes on the sea-coast so as to make them act as a protection to the land behind from erosion by the sea; to prevent them from advancing inland and destroying existing vegetation, and to enable sand wastes where they exist to be reclaimed and planted with trees.

The book does not contain any, or very little, information that is not already given in the work on "The Sea Coast" published in Longman's Engineering Series, or in the report of the Royal Commission on Coast Erosion. The information on the subject dealt with is, however, given in a handy form, and will be found useful and instructive to those interested in coast geology or having charge of land bordering on the sea shore.

The subjects dealt with are: the area of land covered by sand dunes in Europe, the transportation of sand by wind action and formation of dunes, description of existing dunes in this and other countries, devastation caused by inland movement of dunes, methods for preventing dunes moving inland, protective works for face of dunes, and the reclamation of sand wastes.

Notes on the Blue-Green Algae. By Harold Wager. Pp. 48. (London: A. Brown and Sons, Ltd., 1914.) Price 2*s.* 6*d.* net.

THIS little book should be of considerable service to those who desire to study systematically this group of plants, which is characterised by the presence of a bluish-purple colouring matter, phycocyanin, in addition to chlorophyll, in the cells. The cell-membrane is not composed of cellulose and glycogen takes the place of starch in the protoplasm. Mr. Wager first gives a general introduction on the structure, reproduction, and classification of the group, then keys to the orders and families, a key to the genera of the Oscillatoriaceæ, and finally a key to those species of Oscillatoria and Phormidium which are fairly well determined. In the latter it would have been of service if the localities in which they have been found had been mentioned. The book concludes with a glossary and references to monographs and blank pages for notes.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The Hæmoproteus of the Indian Pigeon.

In the course of a letter, which was brought by the last Indian mail, my friend, Colonel J. R. Adie, imparts the very interesting information that Mrs. Adie, working at Kasauli, has recently obtained very strong presumptive evidence that the præter-vertebrate life-history of the Hæmoproteus of the Indian pigeon agrees with that discovered by Ross for the Proteosoma of the Indian sparrow and for the malaria parasite, the intermediary in the case of the Hæmoproteus being a species of Hippoboscid fly of the genus Lynchia.

Mrs. Adie obtained from Amballa some pigeons which were heavily infected with the blood-parasite and abundantly infested with the fly. In sixteen or seventeen individuals of the fly (Lynchia), out of twenty-six examined, she found either zygotes, or cysts, or sporozoites—the last swarming in the salivary-glands, and in some cases coursing down the salivary-ducts. In one case a cyst in the wall of the gut was observed to burst and liberate hundreds of sporozoites.

Mrs. Adie's observations will be published as soon as the exact experiments which were in progress at the time Colonel Adie wrote are concluded; but her observations are in several ways so interesting that I think they ought to be made known at once.

A. Alcock.

Belvedere, Kent, July 28.

Radio-activity and Atomic Numbers.

Mr. van den Broek's letter in Nature of July 9 shows the importance of the charge upon the nucleus in radio-active phenomena. The cause of this may possibly be sought in considerations similar to the following.

If one assumes that an atom breaks up when all the nuclear charges are in a given relative position and that they are in rotation with an average frequency $\nu = E/h$, where E is their energy and h the element of action of the quantum theory, then each particle will pass through the critical position ν times per second. The probability that M particles should be in the unstable region simultaneously is $(k\nu)^M$, or if only relative position is involved $(k\nu)^{M-1}$, where k of course defines the size of the critical region. One would therefore expect a relation between the average life of an atom and the energy of its particles of the form

$$\lambda = (k\nu)^{M-1} = \left(\frac{k}{h}E\right)^{M-1},$$

where λ is the radio-active constant. According to Geiger the range in air is given by the formula

$$R = \frac{v^3}{1{,}24\cdot 10^{27}} = 4{,}05\cdot 10^{-7} E^{\frac{3}{2}}.$$

Introducing this value one finds

$$\lambda = (2{,}77\cdot 10^{18} k)^{\frac{2}{3}(M-1)} R^{\frac{2}{3}(M-1)}$$

or

$$\log \lambda = \tfrac{2}{3}(M-1)(\log k + 18{,}44) + \tfrac{2}{3}(M-1)\log R.$$

Putting M = 85, which would be the average value for radio-active substance, one finds the approximate formula $\log \lambda = 56(\log k + 18{,}44) + 56 \log R$. Geiger found empirically $\log \lambda = -36{,}7 + 53{,}3 \log R$. According to this k would be about 10^{-19}, *i.e.* of about the order $1/\nu$. In any case the close agreement between the theoretical and observed values of the coefficients of log R would seem to show that the original hypothesis is correct in its main outlines, *i.e.* that integration occurs upon the fortuitous coincidence of n events, the probability of which is proportional to $E = h\nu$, and that n is of the order of the atomic number M. One cannot say as yet though whether the n particles, the relative positions of which determine the stability are the positive particles or the electrons.

Mr. van den Broek's formula

$$\frac{(\lambda_{Th})^2}{\lambda_{Ra}\lambda_A} = 4{,}5^{M-82}$$

would reduce to

$$\frac{(E_{Th})^2}{E_{Ra}\cdot E_{Ac}} = 4{,}5^{\frac{M-82}{M-1}} \quad \text{or} \quad \frac{(\nu_{Th})^2}{\nu_{Ra}\cdot \nu_{Ac}} = 4{,}5^{\frac{M-82}{M-1}}$$

The simplest interpretation of this would be that the atoms of corresponding elements of the different series are geometrically similar and differ only in their linear dimensions. A change of the attractive force with the nuclear charge is obviously probable, and Mr. van den Broek's formula will certainly be of the first importance when we attempt to determine the function representing the nuclear forces in terms of the charge and perhaps also of the distance.

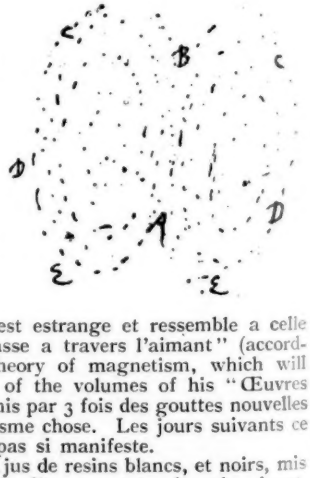
F. A. Lindemann.

Berlin, July 26.

Circulatory Movements in Liquids.

From a manuscript by Christiaan Huygens, containing the description of his microscopical observations in the year 1678, I quote the following passages:—

"5 Sept. Et ayant mis de petites goutes rondes de cette urine sur le talc" (we read at another place: "ayant pris de cette eau et mis dans le microscope entre le verre et le talc"), "Je remarquay avec le microscope que ces œufs, et sans doute la liqueur mesme avec eux, avoient un mouvement continuel par lequel ils montoient dans le milieu AB de la goute et puis descendoient par les deux costes CD, et montoient ensuite encore par AB, et ainsi toujours, car je suivois ces graines, et vis que c'estoient les mesmes qui montoient et descendoient.



"Cette continuation de mouvement est estrange et ressemble a celle de la matiere qui passe a travers l'aimant" (according to Huygens's theory of magnetism, which will be published in one of the volumes of his "Œuvres Complètes"). "Je mis par 3 fois des gouttes nouvelles et vis toujours la mesme chose. Les jours suivants ce mouvement n'estoit pas si manifeste.

"9 Sept. Dans du jus de resins blancs, et noirs, mis en expérience le jour d'auparavant, rien de vivant, mais bien de parties grasses et heterogenes, par lesquelles je remarquay le mouvement dans ce jus que j'avois vu dans l'urine le 5 Sept.

"10 Sept. Jus de resins rien de vivant. Le mesme mouvement y estoit.

"11 Sept. Dans le jus de resins rien de vivant, le mouvement de circulation de mesme que le 10e."

Have such phenomena been observed by other microscopists? Any suggestions about their precise cause would be very welcome.

The manuscript will be published in the next volume of Huygens's "Œuvres," which is in an advanced state of preparation.

Amsterdam. D. J. KORTEWEG.

NATURAL HISTORY AND THE OCEAN.[1]

(1) THIS is a new work on birds by the distinguished ornithologist, Dr. Anton Reichenow, of Berlin, which when completed will consist of two volumes. This, the first, contains a general review of the class Aves, followed by a systematic account of the Ratitæ, Natatores, Grallatores, Cutinares (Deserticolæ, Crypturi, Rasores, Gyrantes), Raptatores, and Fibulatores. Excellent line sketches illustrating special diagnostic characters are imbedded pleasantly in the text. Each family, with the genera included in it, is concisely characterised and its geographical distribution indicated, while of the species the more important are enumerated often with remarks on those of special interest. When finished "Die Vögel" will form, if not a "handbook," at least a compact and useful synopsis of systematic ornithology. Unfortunately, like so many German publications it can scarcely be said to be "bound," for with very little provocation it collapses into an inchoate mass of sheets.

(2) This will prove an invaluable book of reference for all who may have to study the avifauna of not only Australia, but of the southern hemisphere, notwithstanding that many of Mr. Mathews's co-workers will probably disagree with him in the distinctness of the numerous, and, as we think, too numerous subspecies he describes. The introduction provides us with a very interesting ornithological history of Australia, and an important discussion of the faunal regions into which the continent appears to be divided from the point of view of its birds. We observe that he recognises, as we believe rightly, the existence in Australia of an element derived from, or once forming, part of an ancient antarctic continent, then possessing a climate very different from that now existing. The nomenclature adopted by the author follows the several rules of strict priority formulated by the different international zoological congresses of recent years, and of necessity, therefore, sweeps away many names which we cling to from being familiar to us for more than half a century, and which we relinquish, if relinquish them we must, with the deepest reluctance.

Mr. Mathews's "List" represents an amazing amount of the hardest and driest kind of work (to all appearance done once for all), which only those who have some experience in threading the mazes of synonymy can appreciate, and for this ornithological literature must be grateful to him *in saecula saeculorum*.

(3) This is a very disappointing book, full of loose and unqualified dogmatic assertions, such, for example, as: "Many [sea-birds] have for so long a time resorted to rocks . . . that though they may be active enough as swimmers and divers when upon or in the water, they are strangely laborious upon the wing. . . ." How about gannets, pelicans, many cormorants, terns, guillemots? The illustrations are very rough reproductions of pen-and-ink drawings.

(4) Dr. G. A. Boulenger is too well known an authority on the reptilia for anyone to be in doubt as to the value of this volume. "There is no work in the English language," the author informs us in the preface, "dealing with the reptiles of Europe. I have, therefore, endeavoured to supply this desideratum so far as the snakes are concerned." His account of the species found in Europe is preceded by a concise and very excellent introduction, summarising what is known of snakes generally, dealing with their external characters, their anatomy, reproduction, habits, distribution—of which one remarkable fact stated is that the zoogeographical regions into which the world is usually divided do not lend themselves any better than the ordinary divisions of physical geography to the study of the distribution of snakes—and finally, their relation to man. The systematic account is illustrated by a beautiful figure of each species, drawn by Prof. Sordelli, of Milan, for his own and Prof. Ian's "Iconographie Générale des Ophidiens," and reproduced in this volume with his permission.

(5) Mr. B. B. Woodward's "Life of the Mollusca" is another addition to the same excellent series being issued by Messrs. Methuen, to which Dr. Boulenger's belongs. The work gives a succinct account of the history, relationships, and everyday life, with general notes on the anatomy, classification, and distribution of this group of the animal kingdom. The classification here given is based mainly on conchological characters; but in the Mollusca this is never felt to stand on quite the same certain basis as that in other zoological groups, inasmuch as so many of the species are determined upon the house they inhabit, and not on the inhabitants themselves. A very remarkable instance of such a discrepancy was recently discussed in a paper before the Zoological Society, in which the conchological relationships of a new species of Papuina from New Guinea disagreed with those indicated by its anatomical characters. The volume is well illustrated by more than thirty plates, most of the figures of which originally

[1] (1) "Die Vögel." Handbuch der Systematischen Ornithologie. By Anton Reichenow. Zwei Bände. Erster Band. Pp. viii+529. (Stuttgart: Ferdinand Enke, 1913.) Price 15 marks.
(2) "A List of the Birds of Australia." By G. M. Mathews. Pp. xxvii+453. (London: Witherby and Co., 1913.) Price 10s. net.
(3) "The Wonders of Bird-life." By W. Percival Westell. Pp. 128. (Manchester: Milner and Co., n.d.) Price 1s. net.
(4) "The Snakes of Europe." By Dr. G. A. Boulenger. Pp. xi+269+plates. (London: Methuen and Co., 1913.) Price 6s.
(5) "The Life of the Mollusca." By B. B. Woodward. Pp. xi+158+plates. (London: Methuen and Co., 1913.) Price 6s.
(6) "The Peregrine Falcon at the Eyrie." By F. Heatherley. Pp. x+78. (London: *Country Life*, 1912.) Price 5s. net.
(7) "The Holiday Nature-book." By S. N. Sedgwick. Pp. 355+plates. (London: C. H. Kelly, n.d.) Price 3s. 6d.
(8) "The Ocean: A General Account of the Science of the Sea." By Sir John Murray. Pp. 256+xii plates. (London: Williams and Norgate, n.d.) Price 1s. Home University Library.

appeared in the late Dr. S. P. Woodward's well-known "Manual of the Mollusca."

(6) In this volume Mr. Heatherley describes minutely and illustrates fully by a wealth of pictures taken—during successive seasons—from hour to hour during daylight from an adjacent but concealed observation shelter, the intimate nesting history of the Peregrine Falcon from the time the eyrie was tenanted and the eggs laid until the young hatched out and were fed to maturity. The monograph forms an interesting and very valuable record of a long watch pursued with great conscientiousness and endurance, regardless of the many discomforts which it entailed, by the author and his friends who from time to time mounted guard in his place. Mr. Heatherley notes as a previously "unrecorded fact that after the first few days the falcon turned over to the tiercel the duties of her sex, spending his time abroad hunting and bringing the quarry to the tiercel who remained at home to feed and look after the young." As the book is one of the series of studies issued by *Country Life*, it is needless to state that the illustrations—one of which is reproduced, by the courtesy of the publishers—are up to the high standard that we are accustomed to in that journal. It is a pity, we think, that in a work of this character some of the pages should be furnished with very frivolous headlines.

(7) The next volume on our list is written for the "increasing number of people, young and old," who "are interested in popular nature-study." Nearly half of its contents deals with objects of the sea-shore; the remainder is devoted to birds of the garden, spiders, beetles, and moths. Two chapters are given up to nature photography and how to photograph small objects. A specimen nature calendar, with the chief notabilia for each month of the year, partly filled up and left to be completed by the reader, is included. So far as sampled, the information is accurate, and is conveyed in language understandable by those for whom the book is designed. Some of the photographic reproductions might be improved upon.

(8) A book on the ocean by Sir John Murray—

Young Peregrine Falcons, twenty-nine days old. From "The Peregrine Falcon at the Eyrie."

the greatest investigator of the deep and the highest authority on all that concerns the science of the sea—would seem to require no more in the way of review and recommendation than the mention of that fact. Yet it may be well to state that within the compass of 256 pages of thirty lines each we have perhaps the most concise and the most scientific account of this immense subject that has yet been written, set forth in language that the reader most unfamiliar with the subject can grasp with perfect facility. In being, alas! the final contribution to science, we believe, from John Murray's pen, it is sadly appropriate as a summing up of the work to which his long, arduous, and brilliant scientific life was devoted. Its various chapters deal with the methods and instruments of deep-sea research, the depths of the ocean, the physical characters of its waters, oceanic circulation, life in the ocean, marine deposits, and the geospheres. A glossary, a concise bibliography, and a sufficient index close the volume. It is more fully illustrated than most of its predecessors. There are twelve plates, of which six are coloured maps by Bartholomew of wonderful clearness notwithstanding their size, showing the deeps, the salinity, the surface temperatures, the currents, the surface density, and the deposits of the ocean.

THE ADMINISTRATIVE PROBLEM OF SLEEPING SICKNESS.

THE Report of the Inter-Departmental Committee on Sleeping Sickness (Cd. 7349, price 3*d*.), recently published, is a most valuable summary of present knowledge on the subject. The committee have taken the evidence of all the leading authorities on the subject, both British and foreign, and the enormous mass of evidence put before them (printed separately as Cd. 7350) has been very carefully sifted and analysed in the Report, which is signed by all members of the committee with certain reservations by two of them (Dr. W. A. Chapple, M.P., and Mr. J. Duncan Millar, M.P.), who have appended a separate memorandum embodying their opinions with regard to the game question.

The following are some of the opinions or recommendations expressed by the committee with regard to controversial questions either of scientific knowledge or practical administration.

The problems which arise with regard to trypanosomiasis in man in Nyasaland and Rhodesia are wholly distinct from the problems which arise in Uganda. Nyasaland trypanosomiasis is caused by *T. rhodesiense* and conveyed by *Glossina morsitans*; it is a very small factor in the general bill of mortality; it is probably an old and endemic disease, and there appears to be no evidence to indicate that it is likely to become epidemic. On the other hand, Uganda trypanosomiasis is caused by *T. gambiense* and conveyed by *G. palpalis*; it has been known on the west coast of Africa for at least one hundred years, but was first introduced into Uganda at the end of the last century, probably by infected native porters coming from the Congo, and it is believed to have destroyed about 200,000 natives between 1898 and 1906. There is a general agreement among experts that Uganda trypanosomiasis is not endemic beyond the range of *G. palpalis*. *T. rhodesiense* infection is much more virulent than *T. gambiense* infection. All authorities believe the diseases to be distinct, though allied.

The committee considers that the elimination of Glossina as the carrier must be the principal object of all efforts to check or get rid of the disease. The evidence all points to the conclusion that if the tsetse-fly could be eliminated or removed from contact from human settlement, sleeping sickness would practically disappear, infection conveyed by other flies being a negligible factor in the spread of the disease. For this reason the committee attach great importance to a proper and sufficient equipment of entomological research into the bionomics of the incriminated tsetse-flies. This form of research has, in their view, been insufficiently pursued up to the present time. In this form of research there is a large element of chance; accident may at any time lay bare a result which may lead to the solution of the problem, and the multiplication of the workers is the multiplication of chances.

With regard to the vexed question of the reservoir and the advisability or otherwise of game-destruction:—(1) As regards Uganda trypanosomiasis, there is abundant evidence that human beings, infected but able to get about, serve as reservoirs of the virus, maintaining the endemicity of the disease, and that they may in travelling distribute it widely. There is also evidence that in the absence of men wild animals may be a source of the virus. It is doubtful how much importance should be attached to the antelope as a reservoir of *T. gambiense*. The part this reservoir plays is probably small in comparison with infected man, and to a less extent his domestic animals; for cattle, sheep, and goats have been known to harbour this trypanosome and take no harm.

(2) As regards Nyasaland trypanosomiasis, the committee consider the identity of *T. rhodesiense* with the similar trypanosome found in game, in the same districts, as unproven. The wild animals in question are undoubtedly reservoirs of the trypanosomes pathogenic to stock; but the evidence is conflicting as to whether the wild animals which are a reservoir of the disease affecting domestic stock are a danger to man. Knowledge of the disease, its cause, and its remedies, is still in the making, and hasty and imperfectly considered action of a drastic character such as the attempt to effect a general destruction of wild animals is not justified by the evidence before the committee. In Nyasaland and Rhodesia the incidence of the disease on the population is slight and it is not increasing.

The proposed experiment of removal of wild

animals from a selected area may produce valuable results, both as regards knowledge of the habits of the fly, and as to the extent to which the infectivity of the fly and subsequently the infection of man or stock is derived from wild animals. The result of this experiment cannot be confidently anticipated, but, nevertheless, the committee think there is sufficient to justify an expectation of useful results and recommend that if a suitable locality can be found where an experiment can be carried out at a reasonable cost, it should be undertaken.

RECENT STUDIES OF THE ATMOSPHERE.[1]

THE German Meteorological Society offered a prize for the best essay on the results of the International Kite and Balloon ascents, and the prize was won by Mr. Gold in 1912 by the memoir which is now published by the Meteorological Office. The results mostly refer to ascents which took place prior to December, 1909, but in the case of some stations observations are included up to November, 1911. From an exhaustive consideration of the temperature in the free air and its relation to pressure at sea-level, geographical position, and season, it appears that in Europe August is, in general, the warmest month in the troposphere, and March the coldest, except close to the surface; thus, the temperature lag is greater for the minimum than for the maximum, which, as is pointed out in the memoir, is to be expected, for convection can carry warmth upwards, but not cold. It has become apparent from the study of the upper air that a cyclone is colder than an anticyclone, and this is borne out by Mr. Gold's figures; he finds that a cyclone is colder than an anticyclone up to ten kilometres, that is, up to the level of the stratosphere.

The height at which the stratosphere is found, and its temperature, are known to vary with the surface pressure; the higher the pressure the higher is the lower limit of the stratosphere and the lower the temperature of the layer. Mr. Gold has investigated this point in detail and gives diagrams showing the changes in the stratosphere in height and in temperature through areas of high and low pressure, both in winter and summer. The places where sounding balloons fall show that the general drift of the wind over Europe is from the north-west in the upper air. Balloons sent up in easterly winds usually fall to the east of the starting place in winter, showing that at this season an easterly current is shallow, the pressure gradient above being reversed by the gradient of temperature from south to north. Mr. Gold discusses many questions of the winds and the dynamics of the atmosphere, but it is impossible in a short notice even to indicate every point in the work; it should be read by all interested in dynamical meteorology.

Almost all the observations in the upper air in this country are made with Mr. W. H. Dines's light meteorograph. In Geophysical Memoir, No. 6, Mr. Dines describes very fully the method of calibrating, preparing the instrument for the ascent, and working up the trace. With these instructions and those given in a former publication of the Meteorological Office (M. O. 202) an observer should be able to use the instrument to full advantage

Electrical observations of the atmosphere at the new observatory at Eskdalemuir are discussed by Mr. Dobson in the Geophysical Memoirs, and compared with those at Kew. Conditions differ in several respects, being far more disturbed at the northern station. The diurnal curves of the potential gradient for the two stations are similar during the winter, but differ markedly in the summer; at this season the potential at Eskdalemuir is high at night and begins to fall in the early morning when it is rising to a maximum at Kew. The mean absolute value of the potential gradient is always higher at Kew than at Eskdalemuir, which Mr. Dobson attributes chiefly to the abnormally low conductivity of the air at Kew. The small and uncertain difference in the number of ions between summer and winter at Eskdalemuir is remarkable. The station has not been long established, and the account given in this memoir will, no doubt, be amplified when a longer series of observations from Eskdalemuir is available.

The constriction in the tube of the marine barometer, made to avoid oscillations of the mercury, causes a lag which is discussed by Dr. Chree in No. 8 of the Geophysical Memoirs. The theory was considered by Stokes, who found that the marine barometer had a certain "lagging time." If the sluggishness were due to the constriction alone the lag should be too small to affect readings in practice. But Dr. Chree has investigated the problem by the consideration of the readings of a number of barometers tested at Kew, and finds the lag to be considerably greater than according to Stokes's formula. Further observations with the same result were made with two barometers which were subsequently put on board ship, and read every four hours by the ship's officers during a number of voyages across the Atlantic; the lag at sea was found to be much less than on land, and was almost entirely confined to cases where the barometer was "pumping." No explanation is put forward to account for "the extraordinary difference between land and sea results." Dr. Chree is not of opinion that it can be explained by uncertainties of reading at sea. Further observations are hinted at, and it is certainly desirable to find out why on land the lag should be "enormously greater" than given by Stokes's formula, while at sea it is "exceedingly small."

[1] Geophysical Memoirs (Meteorological Office):—
No. 5. The International Kite and Balloon Ascents. By Ernest Gold. (1913.) Price 1*s.* 6*d.*
No. 6. The Free Atmosphere in the Region of the British Isles (Third Report). The Calibration of the Balloon Instruments and the Reading of the Traces. By W. H. Dines, F.R.S. (1914.) Price 3*d.*
No. 7. A Comparison of the Electrical Conditions of the Atmosphere at Kew and Eskdalemuir. By Gordon Dobson. (1914.) Price 8*d.*
No. 8. Lag in Marine Barometers on Land and Sea. By Dr. Charles Chree, F.R.S. (1914.) Price 4*d.*

NOTES.

THE *Endurance*, with Sir Ernest Shackleton and the Imperial Trans-Antarctic Expedition on board, left London on Saturday last. The vessel will leave Plymouth for the Antarctic on Saturday next with a crew of seventeen, and six or eight members of the Weddell Sea-shore party. The remaining members of this party will sail in the middle of September by mail steamer for Buenos Aires.

WE learn from the *Times* that the Scottish Spitsbergen Expedition, under the leadership of Dr. W. S. Bruce, director of the Scottish Oceanographical Laboratory (referred to on p. 512 of NATURE, July 16), left Tromsö on the morning of July 24. Dr. Bruce has chartered the sailing ship *Pelikane*, and is proceeding to Wybe Jansz Water, where he will land a party under the direction of Mr. R. M. Craig on the east coast of the mainland. From there he will go with the ship to Green Harbour, Ebeltoft Harbour, and Prince Charles Foreland. Dr. Bruce will return with the *Pelikane* to Wybe Jansz Water to continue the hydrographic survey of the loch, while Mr. Craig, it is hoped, will be able to carry on the geological researches, which he will have begun during Dr. Bruce's absence in the west.

AN expedition under the leadership of Miss M. A. Czaplicka, who holds a travelling fellowship of Somerville College, Oxford, is being sent out by the Universities of Oxford and Moscow, for the purpose of studying the tribes of the Yenesei region. The other members are Mr. H. A. Hull, of Philadelphia University, in charge of physical anthropological work; Miss Haviland, zoologist and ornithologist; Miss Curtis, photographer. The tribes which will be investigated are the Tungus and Ostiak of the Yenesei, both with Mongoloid affinities, though physically distinct. The question of group marriage, peculiarities of the tribal wizard, and their religion are included in the scope of the inquiry. The expedition will be absent for about a year, and is supplied with carefully selected equipment and provisions.

IT is stated in *Science* that Mr. C. Boden Kloss and Mr. H. C. Robinson, director of museums, Federated Malay States, are engaged in an expedition to Mount Indrapura or Korinchi in Central Sumatra —a volcano 12,700 ft. high, and the highest summit in the island. The objects of the expedition are zoological and botanical, but it is hoped to ascend to the summit of the mountain and make observations of the crater and the present activity of the volcano.

WE learn that the committee of the Capt. Scott Memorial Fund has accepted the offer of the Admiralty of a site at Greenwich Hospital for the erection of the memorial to the explorers who lost their lives in the Antarctic region. It has been stipulated by the Admiralty that the memorial shall harmonise with the architecture of neighbouring buildings.

THE death is announced, at the age of sixty-seven, of M. Paul Reclus, who was largely instrumental in making general the use of cocaine as an anæsthetic in surgery. He was elected a member of the Paris Academy of Medicine in 1895.

MR. JOHN HOOD, whose recent death, at an advanced age, is announced from Dundee, was well known to many zoologists and microscopists as a collector of the more minute forms of fresh-water life and especially of the Rotifera. The study of these attractive little animals was the hobby of his life, and though he published little under his own name, he gave very important assistance to many other workers. It is only necessary to turn the pages of Hudson and Gosse's great Monograph to see how largely they were indebted to him for the material on which they worked, and his name is quoted on almost every other page as authority for some statement regarding the bionomics or occurrence of a species. He was especially successful in obtaining new and curious forms of the sessile Rotifers forming the group Rhizota, which in recent years have been somewhat neglected in favour of the more easily collected free-swimming species. Mr. Hood was a mechanic by trade, and in his later years, when laid aside from work, he was in straitened circumstances, and sometimes perilously near actual privation. Only a year ago, a small pension from the Murdoch Trust, obtained at the instance of some of his scientific friends, brought ease of mind and some comfort to his last days. Probably very few of his numerous correspondents knew him personally, but those who did know that he represented a particularly fine type of the "working-man naturalist," a type which is, perhaps, commoner in the north country than in the south, and which was more characteristic of the nineteenth century than it promises to be of the twentieth.

AS already announced (see NATURE, December 18, 1913), an International Congress of Meteorology is to be held in Venice in September next. From a circular just received, we learn that the Congress will take place on September 17, 18, and 19, and will be divided into three sections, dealing respectively with climatology and agrarian meteorology; aerology; general and maritime meteorology. The communications and discussions are to be in English, French, German, or Italian, and those intending to take part must send their applications and subscriptions to the secretary of the executive committee (Osservatorio Patriarcale della Salute, Venice) before August 31. The subscription will be 10 lire (8*s*.).

THE fourteenth French Congress of Medicine is to be held at Brussels on September 30, October 1, 2, and 3. The president will be Prof. Henrijean, of Liége, and the general secretary Prof. R. Verhvogen, 22 rue Joseph II., Brussels. Among the subjects to be discussed are cardio-vascular syphilis; vaccinotherapy in general, and in particular vaccinotherapy of cancer and typhoid fever; the therapeutic value of artificial pneumothorax; lipoids in pathology.

AN illustrated lecture on the modification of response in plants under the action of drugs is to be delivered on October 30 before the Royal Society of Medicine by Prof. J. C. Bose, of Calcutta.

THE thirteenth competition for the Riberi prize, the value of which is 800*l*., is now open. It is to be awarded for scientific researches in medical science,

and is given under the auspices of the Royal Academy of Medicine of Turin. Names of competitors will be received until December 31, 1916. Entry forms may be obtained from Dr. V. Oliva, secretary of the Royal Academy of Medicine, 18 Via Po, Turin.

LORD SALVESEN, the president of the Scottish Zoological Society, has intimated his willingness to bear the cost (estimated at about 1000*l.*) of the erection of a house in the Zoological Park for the accommodation of the smaller and more delicate mammals.

A CITY GUILD has been established at Coventry having as its object the preservation of historic buildings and places of natural beauty. It will work upon the same lines as the society as Stratford-on-Avon which, though only two years old, has already done good work.

WE have received from the British Association Committee for Radiotelegraphic Investigation copies of the programme of observations to be made during the total solar eclipse of August 21 next, and of the three forms, A, B, and C, which have been issued by the committee for use during the eclipse. Form A is for records of the measurement of signal strength; form B gives instructions and explanatory remarks concerning graphic records; and form C is for observations on strays. It should be mentioned that on the occasion of the eclipse, five high-power wireless telegraph stations in Europe will each make a series of special emissions to provide facilities for the observation of strays, and for the measurement of the strength of signals—hence the issue of the above-named documents. It is requested that experimenters in wireless telegraphy possessing such apparatus of precision as will enable them to make accurate measurements will communicate with Mr. W. Duddell, 56, Victoria Street, S.W. Prospective observers, willing to make aural estimates of signal strength, or to make observations on strays (either by the graphic record method, or by the method of registering the number heard during every thirty seconds), should intimate their willingness and state which portion of the observations they can undertake, to the honorary secretary, British Association Radiotelegraphic Committee, 88, Gower Street, W.C. They should also state the number and the names of the five sending stations with which it would be most convenient for them to work.

THE report of the Astronomer-Royal to the Board of Visitors has been issued as a White Paper. In it it is stated that the old time ball at the Royal Observatory, Greenwich, is to be replaced by a new aluminium ball. The time ball was first erected in 1833. An electric current from the clock was first used to drop it at 1 o'clock in 1852. In 1855 the ball was blown down into the courtyard. Some repairs were made in 1895, when the chain broke during winding, and again, in August, 1913, some temporary repairs were made to the ball.

THE President of the Local Government Board has authorised the following researches to be paid for out of the annual grant voted by Parliament in aid of scientific investigations concerning the causes and processes of disease. These are in addition to the investigations already announced:— (1) an investigation of the details of the technique in carrying out Wassermann's reaction for the diagnosis of syphilis. Major Harrison, acting in collaboration with a sub-committee of the Pathological Section of the Royal Society of Medicine, will carry out this investigation. (2) An investigation by Mr. H. J. Gauvain, in collaboration with the Board's pathological staff, into the cutaneous tuberculin reactions of cases of tuberculosis of bones and joints of bovine and human sources. (3) A continuance of the investigation of Drs. Twort and Mellanby on infantile diarrhœa, with special reference to the conditions governing the absorption of toxic substances from the alimentary canal. (4) A further investigation into the causes of still-births by Drs. C. J. Lewis and Dale.

AN extremely interesting presidential address on "The Service of Medicine to Civilisation" was delivered by Prof. Victor Vaughan before the American Medical Association in June (see *Science*, July 3, 1914). One statement of importance is made, viz., that infectious disease picks out the fit rather than the unfit, and therefore does not benefit the race by the elimination of the unfit. Prof. Vaughan claims increased state-aid for scientific investigation, and says that he has no sympathy with the idea that medical research should be largely relegated to special non-teaching institutions, for the man who is devoid of the spirit of scientific investigation should have no place in medicine as student, practitioner, or teacher!

WE have received No. 4 of the *Indian Journal of Medical Research*, which completes the first volume of this important publication. It contains a number of papers on tropical research, and is well produced and illustrated.

TWO circulars which we have received serve as an illustration of what can be done, and is being done, in the study of nature in and around London. One is from Prof. Flinders Petrie, president of the Hampstead Scientific Society, pointing out the danger of extermination of the majority of the animals and plants in the parts of North London which are now being rapidly built over, and appealing for assistance from residents in and visitors to the district in the attempt of the Hampstead Scientific Society to compile a complete record of the natural species still to be found within three miles of the flagstaff on the summit of Hampstead Heath, communications to be made with the secretaries of the society at 32 Willoughby Road, Hampstead. The second circular is from the curator of the Whitechapel Museum, 77 High Street, E., and consists in a description of the arrangements made for visits of school classes to this museum and to the Nature-Study Museum, both being controlled by the borough of Stepney. Nearly two thousand school classes have visited the museums mentioned during the last four years, while both are available for school visits, the Nature-Study Museum confines itself mainly to the display of living plants and animals, the grounds containing many fine trees and also a wild flower garden with a large collection of growing British plants labelled by their common

names, and in addition to an observation beehive, a large vivarium with reptiles and batrachians, and a collection of the score or so of wild birds which visit or nest in the grounds, there are about seventy freshwater and marine aquaria, containing a fine series of aquatic plants and insects, mollusca, anemones, and fishes.

MR. W. W. SMITH has contributed to the Records of the Botanical Survey of India (vol. iv., No. 7) an interesting account of the alpine and subalpine vegetation of south-east Sikkim, more especially that of the ridges lying between the two passes, Cho-La and Tanka-La. The list of the 925 species of flowering plants and ferns collected is preceded by an exceedingly interesting general description of the flora of this high region, with reference to the climatic and other conditions of the area, one of the wettest in the Himalayas.

WE are glad to learn that the marine biological investigations at the Cape of Good Hope, which were suspended, in part at any rate, for some years, have again been resumed under the direction of Dr. J. D. F. Gilchrist. The Marine Biological Report, No. 1, has now been issued, and contains two papers of considerable economic interest. The first of these is on the Cape crawfish and the crawfish industry. The somewhat changeable history of the industry is recorded, and the prospects of future development discussed. The main part of the paper is, however, devoted to a study of the natural history of the species, which leads up to a consideration of the possible ways in which the industry may be preserved. The second paper contains an account of the various species of the herring and allied families, which live in Cape waters. The number of these is considerable, but it does not seem probable that many of them offer a prospect of a successful fishery.

To the July number of the *American Naturalist* (vol. xlviii., p. 385) Dr. Glover M. Allen contributes the first part of a remarkably interesting and original article on the development of colour-pattern in mammals and birds, dealing in this instance almost exclusively with the development of semi-albinism in domesticated mammals. In the opinion of the author, mammals and birds have five paired centres of maximum development, and a single azygous frontal centre. Where these areas come into contact with one another, that is to say, on their peripheries, the intensity of the pigmentation is, of necessity, much less than at the centres. A consequence of this is the tendency to the development of non-pigmented areas at the lines of junction, such light tracts being denominated "primary breaks." One of such unpigmented areas occurs on the middle line of the lower surface of the body; there is another between the ear-patches, and a third on the side of the neck. In piebald horses and cattle an unpigmented tract is very generally situated in the neighbourhood of the shoulder, and another in the lumbar region, one or both of which may embrace the associated limb. How very closely the colour-pattern of horses agrees in this respect with that of cattle is made apparent by the figures with which the article is illustrated, and it will not fail to be noticed that the two main light tracts approximately follow the lines of the limb-girdles, as was pointed out years ago by a writer to whom the author appears to make no reference. "Dappling" in horses, which has been regarded as an archaic feature, is considered by Dr. Allen to be more probably a secondary development.

DR. ROLF WITTING continues to carry out most valuable hydrographical work in the Gulf of Finland, and in *Finlandändische Hydrographisch-Biologische Untersuchungen*, No. 12, the observations for the year 1912 are published. As in former years, salinity and temperature observations have been made on special cruises, as well as more continuous series of observations on lightships. The ice conditions are also fully recorded. Finland is to be congratulated upon having carried out its hydrographical work for a number of years in a thorough and systematic way, being in many respects considerably ahead of some of the larger countries that took up this work in 1903, in connection with the International Fishery investigations.

To the April issue of the Proceedings of the Philadelphia Academy Dr. N. E. McIndoo contributes a long article on the olfactory sense in Hymenoptera, as exemplified by ants and hornets. The special object of the experiments on which the article is based was to establish, in the first place, the relative sensibility of these insects to various odours; secondly, to ascertain the situation of the olfactory organs; and, thirdly, to determine how other Hymenoptera compare with ants and hornets in the perception of scents. Various opinions have been held with regard to the seat of smell in insects, but the general view at the present day is that this is situated in the antennæ, although it has been pointed out that since these appendages are coated with hard membrane, they are ill-fitted to receive and assimilate olfactory stimuli. Dr. McIndoo finds that the so-called olfactory pores of the legs and wings are the true smelling organs, and that the antennæ take no part in the olfactory function.

PUBLICATION No. 192 of the Carnegie Institution includes (p. 263) a contribution by Dr. Ch. Schuchert on the "Climates of geologic time," in which much attention is paid to the occurrence of glacial epochs from the "proterozoic" periods to recent times. The author regards crustal deformations, which may possibly be rhythmic, as the most potent cause of climatic change. Dr. Schuchert, in association with Prof. Barrell, has just issued another paper of wide import, "A revised geologic time-table for North America" (*Am. Journ. Sci.*, vol. xxxviii., 1914, p. 1), which also emphasises the conception of rhythmic movements of the surface. These produce marked changes in the fauna, especially on land. The table summarising our knowledge of pre-Cambrian history will be useful to many teachers.

PROF. W. H. HOBBS has published, through the Macmillan Company of New York (price 1s.), a pamphlet on "Simple Directions for the Determination of the Common Minerals and Rocks," with an appendix on geological maps and models; the use of wooden blocks, the inclination of which can be varied, to

represent the outcrop of strata is distinctly suggestive. A student of geology should know much more about the foundations of mineralogy than is here given; but these pages were originally drawn up as a supplement to the author's physiographic work on "Earth Features and their Meaning."

MR. H. DEWEY'S well-illustrated account of the geology of North Cornwall, in the Proceedings of the Geologists' Association, vol. xxv. (1914), part iii., will aid many visitors to the county. The conspicuous plain that cuts across the structure of the country at 300 to 400 ft. above the sea is regarded as due to marine denudation occurring in Pliocene times. A steep bluff represents the coast-line limiting this plain. Mr. T. C. F. Hall adds a petrological study of the St. Austell granite, in which the important problem of kaolinisation is discussed.

GEOLOGISTS may note in *Fortschritte der Mineralogie*, for 1914, an elaborate review, by M. Stark, with a bibliography of 534 entries, on the question of petrographic provinces. From the work of Judd in 1876, who is quoted in the bibliography as "W. Judd," we are brought through a large number of regions where relationships have been claimed for igneous rocks of diverse characters. As a result of this survey, two main groups, already unfortunately named by Becke Atlantic and Pacific, are held to be well established, and we are led to understand that an original magma combining these materials no longer exists as an important feature of the crust. The author concludes that the Pacific type dominated in early geological ages, while the Atlantic type has been brought almost to an equality with the Pacific since Eocene times, and will ultimately prevail completely over it.

THE Geological Survey of New Jersey, under the care of Dr. H. B. Kümmel, has issued a "Geologic Map" of the State on the scale of 1 : 250,000. The general strike of the beds, whether Palæozoic or Mesozoic, is north-east and south-west, and influences one great feature of the country, the course of the Delaware River, which forms the frontier for fifty miles along the foot of Cretaceous escarpments. The Hudson on the east similarly works down along the strike under the famous Triassic dolerite "palisades." The choice of colours gives a highly artistic character to the map.

IT is frequently observed that in certain conditions of the atmosphere unusual visibility of distant objects exists. In *Symons's Meteorological Magazine* for December last, Mr. S. Miller referred to the phenomenon and asked what are the physical conditions that produce it, and whether it is admitted to be a prognostic of rain. An interesting discussion followed, in which several well-known men of science have taken part. Opinions as to the prognostic are about equally divided. Mr. W. H. Dines (Mag. for June) thinks visibility is more prevalent in rainy weather, but after, just as much as before, rain. Also, that haziness is dependent on the character of the district from which the air comes; smoke from the London or Clyde districts can be traced for a hundred miles. Dr. John Aitken (Mag. for July) concludes, from a large number of observations at Falkirk (Stirling), that transparency is adversely affected (1) by humidity, and (2) by the density of the population in the direction from which the wind blows. There is, however, no doubt as to the general popularity of the rain prognostic; a former careful observer (Rev. G. T. Ryves), referring to the well-known rhymes sometimes ascribed to Dr. Jenner, and including the line: "The distant hills are looking nigh," remarks that visibility is "one of the most generally accepted signs of rain."

SINCE their systematic classification by Luke Howard in 1803 and the modifications introduced by international agreement in recent years, the observation of the forms and motions of clouds has become one of the most important aids to successful weather study, and Prof. W. Davis remarks in his excellent "Elementary Meteorology" that "if the observer wishes to learn something of atmospheric processes for himself, he should give at least as much time to cloud observations as to all other records put together." We therefore welcome an interesting address to the Occidental College on the clouds of California by Dr. F. A. Carpenter, local forecaster of the U.S. Weather Bureau. Although occupying only eighteen pages it contains much useful information on the composition and formation of clouds. To the usual nomenclature he adds a local form: *el velo*, sometimes known as "high fog," which occurs morning and evening between May and September along a large part of the coast. Storm clouds are most frequent over the northern portion of the State, where cloudless days average less than 100 in a year; in the southern part, *e.g.*, at San Diego, there are nearly 300 cloudless days. Notwithstanding the proverbial sunny skies of California, the author states that most of the known varieties of cloud can be observed there.

THE current *Bulletin* of the Imperial Institute (vol. xii., No. 2) contains among the reports of recent investigations by the scientific and technical staff the results of the examination of soils from Nyasaland, of penguin guano from the Falkland Isles, and of flax from the East Africa Protectorate, where there is every prospect of the cultivation of this fibre becoming established in Nyanza Province. Other reports relate to cocoa from Nigeria, copals from British West Africa, and cohune nuts from British Honduras. Coffee cultivation in Uganda is dealt with by Mr. W. Small, botanist of the Department of Agriculture in this colony. Coffee is now the staple crop of European planters in Uganda. The area is being extended, and large increases in the exports of coffee may be shortly looked for. An article on the utilisation of fish and marine animals as sources of oil and manure discusses the composition and uses of fish oils, their sources and preparation, and describes the present position of the whaling industry. Fur farming in Canada and the tin resources of Malaya and India are dealt with in separate articles. Considerably more than half of the world's supply of tin is now produced within the British

Empire; the output in 1911, the latest year for which final figures are obtainable, was: British Empire 60,497 tons, foreign countries 54,051 tons.

No. 3 of vol. viii. of the *Biochemical Journal* contains two papers, emanating from the Lister Institute, of great general interest. The first, by Mr. Evelyn Ashley Cooper, deals with the curative action of autolysed yeast on avian polyneuritis; the solution obtained retains its curative power for at least eight weeks, and is apparently quite non-toxic. The autolysis of brewers' yeast should therefore afford a simple, inexpensive method of preparing a solution suitable for the oral treatment of human beri-beri. The second paper deals with the bases of gas-works tar, which are believed to be the predisposing cause of pitch-cancer, with special reference to their action on lymphocytes, and a method for their inactivation. The bases which are capable of exciting cell-division are found to occur in the anthracene fraction of the tar, and two bases of this kind have been isolated in the form of picrates, but have not yet been identified satisfactorily. A simple method of rendering these bases inactive consists in heating the tar to a temperature of about 160°, and blowing ordinary or ozonised air through it; in this way the auxetics are rendered harmless by oxidation.

FOR many years considerable inconvenience has been experienced in the sheet-metal trade in consequence of misunderstanding as to the recognised gauge for iron and steel sheets and hoops. A series of sizes known as the "B.G." gauge, or Birmingham gauge, was adopted by the South Staffordshire Ironmasters' Association in 1884, and were very generally accepted in the trade concerned; but many buyers have persisted in ordering sizes belonging to other systems, such as the "B.W.G.," or Birmingham wire gauge, which has no legal status, and is often confused with the imperial standard wire gauge legalised in 1883. Neither of these gauges is, however, recognised in the iron trade for sheets and hoops, and, in consequence, mistakes have often been made, leading in some cases to litigation. At the instance of the metal trades section of the London Chamber of Commerce, the Board of Trade was approached in 1912 with a view to the legalisation of the "B.G." gauge, and, after consideration, they decided in August last to prepare the necessary order in council. This order in council has now been issued, and comes into operation on November 1 next, on which date all the "B.G." sizes from 15/0 B.G., or 1 in., to 52 B.G., or 0·00095 in. will become legal denominations of imperial measure, and will accordingly be admissible for verification and stamping by inspectors of weights and measures. In the interest of the metal trade generally, it is to be hoped that the illegal and arbitrary "B.W.G." will then cease to be specified by purchasers.

AN admirable "Report on Radiation and the Quantum Theory," by Mr. J. H. Jeans, has been published by the Physical Society of London. It contains an introductory portion showing in simple language the need for a quantum theory, followed by a general discussion of the radiation problem on the lines of the classical mechanics, an account of the development of the quantum theory, and special chapters on line spectra, photo-electric effects, and specific heat. The need for some theory not based upon Newtonian mechanics is shown by the fact that in all known media there is a tendency for the energy of any systems moving in the medium to be transferred to the medium, and ultimately to be found in the shortest vibrations of which the medium is capable. Thus, a system of corks connected by springs, and floating in a tank of water, will transfer any vibrational energy they have to water-waves, and ultimately to molecular heat. This tendency, which results from Newtonian mechanics, is not observed in the phenomena of radiation. Otherwise a hot body in a perfectly reflecting enclosure would transfer all its heat to the æther within the enclosure. Max Planck got over this difficulty by supposing that radiant energy is not emitted until it has reached a certain minimum quantity or "quantum." However difficult it may be to imagine such a process, Mr. Jeans agrees with the late Henri Poincaré that some such discontinuity in the structure of energy is imperatively required by experimental evidence.

THE June issue of the Memoirs of the Manchester Literary and Philosophical Society contains seven memoirs, and extends to 140 pages. The whole of the memoirs have been issued separately by the society during April and May at intervals subsequent to their reception which vary from one to four months, the average being about two and a half months. This average does not differ much from that which obtains in the Royal Society of London and other societies. The various memoirs cover a wide range of subjects. One by Mr. R. F. Gwyther introduces a new specification of stress from which a great simplification of treatment results. Another by Mr. W. Cramp describes measurements of the flow of air through pipes, but ignores the work published by the National Physical Laboratory on the subject during the last four years. Mr. A. D. Hall, in a third memoir, shows how the old view that the plant derives nutrition direct from fertilisers in the soil represents the facts better than the newer one of Messrs. Whitney and Cameron, according to which all soils give a soil solution of the same composition from which the plant derives its nutrition and into which it excretes substances toxic to its kind. Two memoirs by Messrs. T. A. Coward and W. M. Tattersall are devoted to a valuable survey of the fauna of Rostherne Mere, a secluded fresh-water lake in the north of Cheshire. These remarks suffice to show that the society maintains a high standard in its memoirs.

IN a paper read before the Tokyo Physico-Mathematical Society in April, which appears in the June number of the Science Reports of the Tohoku University, Prof. K. Honda puts forward a new theory of magnetism which appears to follow the experimental facts more closely than any previous theory. It is based on the following assumptions. The molecules,

or in a solid, the molecular groups, which are in thermal agitation, have magnetic moments which are functions of the temperature. Their action on each other is due partly to actual impacts, partly to the magnetic field each sets up in its neighbourhood. In general the second effect is small compared with the first. When an external field is applied, both the impacts and the molecular fields tend to oppose the rotation of the magnetic axes of the molecules or molecular groups into line with the field. If the molecules or groups are elongated in shape the impacts almost entirely prevent rotation and the substance is paramagnetic. If the molecules or groups are spherical the impacts have only a small effect, rotation is resisted mainly by the mutual magnetic actions and the substance is ferromagnetic. Diamagnetism he considers to be atomic in nature and only another aspect of the Zeeman effect.

OUR ASTRONOMICAL COLUMN.

COMET 1913*f* (DELAVAN).—The following is the ephemeris for Delavan's comet (1913*f*) for the current week (*Astronomische Nachrichten*, No. 4739):—

		R.A. (true)				Dec. (true)				Mag.
		h.	m.	s.		°	′	″		
Aug. 6	...	6	21	19·9	...	+40	40	17·9		
7	...		24	46·8	...	41	0	47·7	...	6·1
8	...		28	18·3	...	41	21	20·0		
9	...		31	54·4	...	41	41	53·7		
10	...		35	35·7	...	42	2	28·0		
11	...		39	21·8	...	42	23	1·9	...	5·9
12	...		43	13·2	...	42	43	34·5		
13	...	6	47	10·0	...	+43	4	4·6		

The current number of the *Observatory* (August) states that this comet was detected by Mr. W. H. Steavenson on July 4 at an altitude of 1°. It was of about the 6th magnitude, had a nucleus of magnitude 7·5, and a head of five minutes in diameter; daylight prevented the tail from being observed. It is expected that the object will be visible to the naked eye in September and October, but no more confident prediction than this can now be made.

NEBULAR ROTATION.—In this column on June 4 (vol. xciii., p. 361) reference was made to an announcement by Prof. Lowell of the discovery, by spectroscopic means, of the rotation of the Virgo Nebula. Dr. V. M. Slipher now publishes (Lowell Observatory Bulletin, No. 62) a brief communication describing in more detail the discovery in question. It seems that about a year ago a spectrogram of the Virgo Nebula N.G.C. 4594 showed the nebula lines to be inclined. A second plate verified the above, but was not considered sufficiently satisfactory to warrant a public announcement of the discovery. A recent photograph confirms the previous deduction, and it is stated that the inclination of the lines, which is analogous to that produced by the diurnal rotation of a planet, "is unmistakable, and leads one directly to the conclusion that the nebula is rotating about an axis." This nebula has a radial velocity of fully a thousand kilometres a second. The nebula is of a "spindle" type, and the slit of the spectroscope was placed over the long axis: these nebulæ are thus spirals seen edgewise, as previous observations of their form have led one to believe. The fact is now proved. Dr. Slipher promises the details of the observations in a general discussion of the spectrographic observations of nebulæ made since 1912. Some of the numerous spectrograms of nebulæ taken at Flagstaff have shown indications of inclined lines, among them being the great nebula in Andromeda, and he hopes to give a definite answer to the important question of the rotation of this the greatest of spiral nebulæ.

SOLAR PHYSICS OBSERVATORY, CAMBRIDGE.—The first annual report of the director of the Solar Physics Observatory, Cambridge, to the Solar Physics Committee covers the year commencing April 1, 1913. The introductory remarks contain a statement indicating the circumstances in which the observatory is now administered, and deplore the loss of three members of the committee, namely, Sir George Darwin, Sir Robert Ball, and Sir David Gill, since the appointment of the committee in June, 1912. After a reference to the purchase of additional land extending down to the Madingley Road and to the selection of instruments to be used, the new buildings are next described. These include an extensive and complete laboratory building forming an extension at the west end of the astrophysical building, a spectroheliograph house, a dome 27 ft. in diameter for the 3-ft. reflector, etc. The energies of the staff are stated to have been chiefly confined to getting the observatory into working order, and for this reason systematic work not involving fresh observations was undertaken, and night work put somewhat in abeyance. Under the heading "Stellar Work," the photographic and visual observations made with the Newall telescope are recorded. These consist of spectrograms of variable stars and visual observations of the spectra of fine novæ. A discussion of spectrograms of Nova Persei No. 2 has been completed, and an atlas of typical stellar spectra with assigned chemical origins of the lines is in course of preparation. Under the heading, "Solar Work," that with the spectroheliograph and the McClean solar instruments is dealt with, while in meteorological physics a brief account is given of the investigations in atmospheric electricity and experimental work on ionising radiations. Preparations were made for the observations of the coming eclipse of the sun, the director and two members of the staff planning to take up their station near Feodosia in the Crimea.

ANNALS OF THE ROYAL BELGIUM OBSERVATORY.—The second part of vol. xiii. of the Annals of the Royal Observatory of Belgium contains three separate memoirs. The first is confined to the details of observations of variable stars made at that observatory during the period 1907 to 1912 by Messrs. G. van Biesbroeck and L. Casteels. Forty-six stars are here studied and the total number of observations published is 3225. Chief attention has been paid to new variables which have not been well studied. In many cases their identity was so ambiguous that the authors have studied the stars themselves, and for the sake of future observers have published charts of the regions where those stars were not included in the Bonner *Durchmusterung*. In many cases light curves accompany the text. The second portion of the volume brings together the observations made with the 38 cm. aperture equatorial by Dr. G. van Biesbroeck during the period 1907 to 1912; these comprise the observations of double stars, comets, minor planets, and phenomena. The third and last portion, by M. L. Casteels, summarises the physical observations of comets made by him in the years 1910 and 1911. Both the second and third portions are accompanied by numerous illustrations of the details observed in comets' heads.

THE ABERDEEN MEETING OF THE BRITISH MEDICAL ASSOCIATION.

AT the meeting of the British Medical Association held in Aberdeen during the last week of July, the presidential address was delivered by Prof. Sir Alexander Ogston, the distinguished surgeon, whose classical reseaches on the organisms of suppuration constitute a landmark in the history of bacteriology in this country. Prof. Ogston described the foundation in Aberdeen of the first medical school in the United Kingdom, and paid a tribute to the sagacity of Bishop Elphinstone, who in planning the university provided for a faculty of medicine.

The sectional addresses were of the usual character, surveys of progress in the various departments of medical and surgical science.

To the proceedings of the various sections several interesting contributions were made. In the course of a discussion on the cause of death under chloroform, Prof. MacWilliam stated that so long ago as 1887 he had pointed out that the cause of sudden cardiac failure under chloroform was due to ventricular fibrillation. With continuous administration of chloroform there was no danger of fibrillation and sudden collapse, but with intermittent administration the case was otherwise. Fibrillation was due to sudden increase of chloroform vapour during the sensitive stage. Omnipon and choral previously administered gave no protection. Dilatation of the heart was not protective. With normal and increased vagus control, fibrillation is prevented. Removal of vagus control is apt to lead to fibrillation, afferent impulses then constituting a danger. The acapnia hypothesis of Henderson did not meet the facts.

During the discussion on the pathology of heart function Dr. Lewis brought forward evidence to prove that fibrillation was due to independent action of the muscular fibres of the heart. In the case of heart-beats, either in response to normal physiological impulses or in response to a weak faradic current, if two pairs of contacts were placed on the heart one above the other and in close proximity to each other, string galvanometer curves taken during the contraction of the cardiac muscle from both pairs gave electrocardiograms of similar pattern. But in auricular or ventricular fibrillation tracings from the same leads showed no similarity of pattern. Consequently he concluded that in fibrillation the adjacent muscle fibres were acting independently of each other.

Dr. Ivy Mackenzie, discussing the anatomy of the primitive specialised cardiac tissue in birds, pointed out that there was no sino-auricular node and no auriculo-ventricular bundle similar to the Bundle of His.

A muscular connection between auricle and ventricle did exist on the right side of the heart near the coronary sinus. In the heart of the guillemot a node of specialised tissue could be demonstrated at the junction of the inferior vena cava and right auricle.

During a discussion on carbohydrate metabolism, Dr. MacLean demonstrated a valuable method of accurately and quickly estimating the amount of sugar in about 2 c.c. of blood.

Prof. MacLeod (Cleveland), discussing the glycogenic function of the liver, stated that although the Claude Bernard doctrine regarding the fate of the glycogen stores of the liver no doubt holds true for strictly physiological conditions, this was not the case in certain experimental conditions such as hydrazine and phosphorous poisoning. Evidence was brought forward to show that even in the typical forms of hyperglycogenolysis much of the glycogen also becomes discharged into the blood of the hepatic veins as a colloidal (dextrinous) body and in the condition of local asphyxia of the liver as lactic acid. The lactic acid content of the blood leaving the liver was assayed by the method of von Fürth and Charnass.

Dr. Cathcart gave a short communication of much interest on the *rôle* of carbohydrate in nutrition. He pointed out that it was no longer possible simply to assess the value of a diet on its caloric content. It had, of course, always been admitted that there must be a sufficiency of protein present, but it was generally believed that fats and carbohydrates were mutually replaceable in isodynamic amounts. Dr. Cathcart stated, as regard carbohydrate, it might be accepted as an established fact that a certain proportion of this material must be present in a diet. In support of this he gave an account of a series of experiments in which the degree of protein catabolism was investigated on diet consisting of olive oil and varying amounts of pure glucose. He maintained that his results showed conclusively that although carbohydrates and fats were mutually replaceable to a certain extent, this replacement could not be carried out to the complete exclusion of carbohydrate.

In the neurological section Dr. James McIntosh pointed out that the failure of antisyphilitic remedies to influence the conditions known as parenchymatous syphilis was due to their not being able to pass through the capillaries of the brain to the nerve substance proper. The cerebro-spinal fluid was not the lymph of the brain, and these remedies did not reach the brain by this channel, as had been suggested. He had failed to find any improvement in cases treated by intrathecal injections of salvarsanised serum or of neo-salvarsan, and did not believe this newer method would have any permanent vogue.

In the bacteriological section, Drs. Hort and Ingram discussed the cocco-bacillus they had recently isolated from typhus patients, which on injection into the Bonnet monkey in several cases produces a high continued fever after an incubation period.

THE HAVRE MEETING OF THE FRENCH ASSOCIATION.

THE forty-third congress of the French Association for the Advancement of the Sciences, which has just been held at Le Havre, was noteworthy for the invitations extended by that association (1) to those members of the British Association who did not attend the Australian meeting, (2) to the delegates of the Corresponding Societies of the British Association. Both invitations were accepted by a number of English visitors, who were accorded a very hospitable reception. At the opening meeting of the congress, held in the Havre Theatre, "God save the King" was played by the orchestra, the whole assembly rising in honour of the English national anthem. M. Armand Gautier presided, and (after speeches of welcome had been delivered by M. Morgand, the maire of Havre, and M. Jules Siegfried) called upon Sir William Ramsay, as the principal delegate of the British Association, to address the meeting. This he did in a discourse which was felt to be charming and sympathetic. He referred to the community of races between the French and the English, to the ninety-nine years of peace that have subsisted between the two nations, and to the illustrious men of science that each has produced, associating the immortal names of Pasteur and of Lister, both of whom had saved more lives than the most sanguinary of wars had destroyed. M. Gautier then delivered his presidential address, in which he referred to recent studies in hydrology and oceanography, with especial reference to their bearing upon the welfare of the town in which the meeting

was held, and spoke eloquently of the sea as contributing to the grandeur of the countries which it washes and to the heroism of their inhabitants. The annual report of the association was then read by Dr. Loir on behalf of the secretary, and gave evidence of good scientific work in various directions and of a sound financial condition. In the evening a reception was given by the municipality in the Hôtel de Ville.

On Tuesday morning a prehistoric exhibition was opened in an annexe of the Museum of Natural History. It comprised a selection of false antiquities, a large collection of palæolithic implements found in the bed of the Seine, at Le Havre, and a well-classified collection of neolithic objects. The other contents of the Natural History Museum were described by Dr. Loir, the curator.

At the meeting of the Conference of British Delegates of Corresponding Societies which, by the courtesy of the French Association, was made part of the proceedings of the Congress, and was held in the Salle des Conférences of the Hôtel de Ville, the chairman expressed the gratitude of the delegates to the Association for the compliment thus paid to them. The absence of Sir George Fordham, who had been nominated President of the Congress, was a disappointment, but it was, to some extent, made up for by his having sent the MS. of his presidential address, which was read. It comprised an interesting account of the origin of these conferences, in which Mr. John Hopkinson was the principal actor, and which have now been held for more than thirty years. The number of corresponding societies and of delegates has continuously increased, and the papers read at the conferences, the annual reports of the Corresponding Societies Committee, and especially the annual lists of papers read before local societies have been of great value; but Sir Geoge Fordham was of opinion that the advantages proposed by these annual conferences had not been fully realised, and attributed it, to some extent, to a want of interest in their work on the part of the secretaries of some societies, an evil for which he was unable to suggest a remedy. A similar opinion was expressed by Dr. Garson, but Dr. Bather and Mr. Hopkinson entertained a different view. A paper was then read by Mr. John Hopkinson on local natural history societies and their publications. He restricted his observations to those societies which were formed for the definite and practical purpose of investigating the natural history of the locality in which they are formed. He urged upon such societies the necessity of division of labour, one member acting as meteorological recorder, another as geological recorder, another as recorder of birds, and so forth, after the plan adopted by the Hertfordshire Natural History Society, of which Mr. Hopkinson is the secretary. For members who are not workers, popular lectures should be provided. He considered the subject of the publications of the societies entirely from the point of view of a bibliographer. On this he had many practical suggestions to make. Especially he urged that the papers printed should be those giving the results of original work, and he gave further examples from the publications of existing societies of the way in which this should be done, and emphasised the importance of accurately dating every publication. Dr. Loir approved of Mr. Hopkinson's recommendations generally, but said that if they were constituted into rules, the system would not go down with French societies, who were too solicitous of their independence to agree to work on a uniform system. The subject was afterwards further considered at a conference over which M. Ray presided, on the organisation of French societies.

Besides the prehistoric exhibition, a retrospective marine exposition, and expositions of medical electricity and of odontology were organised by the sections respectively concerned.

The French Association has not the same dread of a multiplicity of sections that we entertain in England, inasmuch as the number of separate sections was not fewer than twenty. It is impossible in so short a notice as this to do justice to the work undertaken by all of them, but a few of the subjects dealt with may be noted.

The questions submitted to the section of anthropology, over which Prof. Gidon, of Caen, presided, related entirely to Normandy, and dealt with its ethnography, its prehistoric deposits, its megaliths, and the recent discoveries in its prehistory. A subsection of this section was devoted to history and archæology, under the presidency of Dr. Leroy, of Le Havre. Here were discussed the Roman roads, their points of termination on the Norman coasts, and their relation with England, the Roman camps of the valley of the Seine, the Norman influences on the architecture of England, the appearance and development of statuary in Normandy, and other like subjects.

The section of political economy and statistics, of which M. Granet was president, considered the utility of commercial agents to the foreigner, the increase in the cost of living, and a *projet de loi* upon the unification of measurements.

Prof. Ray was president of the section of pedagogy and instruction, where were to be discussed the questions of after-study, of the place of the Press in popular instruction and education, of the utilisation of museums in all branches of education, and of the educative value of the constitution of a conference of affiliated societies in connection with the French Association.

The French Association, like the British, has had to create a special section for agronomy, and this was presided over by M. de Coninck. It considered many questions of breeding, agricultural industry, rural economy, and agricultural engineering.

As in England, the great subject of physics, comprising mathematics, astronomy, geodesy, and mechanics, in respect of which two sections had been combined into one, asserted its pre-eminence, and M. Mesny, director of the School of Hydrography of the Navy, presided over both. Naturally, the subject of naval construction was one of those considered, and others were the history of the calculating machine and its possibilities, and the biography of those mathematicians whose careers have shed lustre on the departments of the Seine Inférieure.

Two sections were also combined to deal with the sciences of navigation, aeronautics, and civil and military engineering. To these a large number and variety of questions were submitted, including maritime fishery, the stabilisation of aeroplanes, canal transit, wireless telegraphy, and other problems of the day. M. Gobin was the president of the combined sections.

The section of meteorology and terrestrial physics was presided over by M. Georges Lemoine, of the Institute. It considered maritime meteorology, surface winds, and the local meteorology of the department.

The section of geology and mineralogy had for president M. Bigot, dean of the Faculty of Sciences, and the questions submitted to it related almost wholly to the geology of the district in which the meeting was held.

The section of medical sciences, presided over by Dr. Paul Engelbach, of Le Havre, also devoted itself largely to local problems, but it also took into consideration alcoholism, the transfusion of blood, anti-

typhoid vaccination, and leprosy. Other medical sections were those of pharmacological science, medical electricity, odontology, chemistry, hygiene, and public medicine.

The geographical section, of which M. Dupont was president, had on its programme the subjects of the Panama Canal, the Channel Tunnel, and many matters of more local interest.

The French Association may well be congratulated on its Havre meeting.

IMPERIAL CANCER RESEARCH FUND.

THE annual meeting of the general committee of the Imperial Cancer Research Fund was held on July 21, the Duke of Bedford, K.G., president, in the chair. Among those present were Sir R. Douglas Powell, Sir Thomas Barlow, Sir Rickman Godlee, Sir William Church, Sir W. Watson Cheyne, Sir John Tweedy, and Prof. Sims Woodhead.

Dr. Bashford's report stated that during the past year fewer claims to the possession of a cure for cancer had been brought to the notice of the fund. In no instance was the information of a kind to necessitate further inquiry. None of the alleged remedies were new, all having been brought to notice in one form or another in earlier years.

The Two Categories of Transplanted Tumours.

As a result of the work carried out in the laboratory, it was becoming more and more generally recognised that transplanted tumours fell into two main categories, namely, a very small group which grew progressively because they did not produce resistance to their own growth, and a large group in which the tumours tended to disappear spontaneously in varying proportions because of the resistance to their growth, which was induced in the body as a result of their presence; indeed, in extreme cases, every animal, as it were, cured itself. The claims to cure cancer in mice had without exception been made by investigators who had not recognised the latter fact with regard to the propagation of tumours, and who had been dealing with the latter class of tumours not supplied from the laboratory of the fund. The Imperial Cancer Research Laboratories had distributed widely a tumour-strain of the former class which grew progressively in all animals and produced metastases, and these were the tumours which ought to be employed for the purposes of therapeutic experiments; up to date no successful results had been obtained with them. It seemed well to emphasise these facts because most, if not all, the transplantable tumours in the possession of other investigators did not fully reproduce the natural features of cancer, and a large number of proprietary preparations, many of them metallic and possibly dangerous, were now on the market as cures for cancer, on the basis of these untrustworthy laboratory experiments.

Resistance to Growth.

Further investigations had been conducted into the nature of the resistance which, as previously reported, can be induced in animals so as to render them refractory to the growth of transplanted tumours. Advances of a purely technical character have permitted it to be demonstrated that resistant animals possess the power of destroying cancer-cells introduced into the blood-stream. The question of resistance to growth is of great etiological importance, because it has been shown that when tumours previously capable only of transitory growth acquire the power of progressive growth and of dissemination, the result is due to the loss of power to produce hindrance to their own growth.

Abderhalden's Serum Test.

Abderhalden claimed that the serum of cancer patients had the power of breaking down or digesting tumour tissue in a test-tube in a way that normal serum did not, and by a special technique a colour-reaction might be obtained which was held to be diagnostic of cancer. The technique had been improved, and it was now possible to avoid contradictory results. It appeared that reliance ought not to be placed on this reaction either in pregnancy or in the diagnosis of cancer.

Increase of Cancer in Certain Situations.

It was quite justifiable to make such a crude statement as that the number of deaths assigned to cancer had increased in 1911 for females to 1088 a million living in 1911, as compared with 500 in 1860; and for males to 891 from 200 during the same period. It was also justifiable to express these facts in another way (also crudely), namely, that of women attaining the age of thirty-five, 1 in 12 was recorded as dying of cancer in 1889, but 1 in 7·4 in 1911; and of men 1 in 21 in 1889, but 1 in 9·7 in 1911. But these figures ought not to be set out, as they still were, before the public without any qualification, and interpreted forthwith as a demonstration of the reality of the increase of cancer. The increase in the number of deaths was not uniform for the different parts of the body, and for some parts, notably the uterus, an actual fall was persistently evident since 1902.

Heredity.

There were still no trustworthy data available as regards cancer in man. In mice hereditary predisposition had been shown to exist, sufficient to double the incidence of cancer in female mice in the ancestry of which cancer had occurred not further back than the grandmother, as compared with animals in which the cancerous ancestry was more remote.

Cancer Areas and Cancer Houses.

The question of cancer houses had been allowed to stand over until experiment and the improvement in the collection and tabulation of statistics had advanced to a point which made it possible to discuss the subject on the basis of positive knowledge. With the awakening of interest in the study of cancer in animals, the belief in cancer houses was naturally transferred to "cancer cages," largely on the basis of statements made by breeders. The extensive experience of the Royal Prussian Institute for Experimental Therapeutics agreed with the even larger experience of the Imperial Cancer Research Fund under laboratory conditions. Cancer cages, in the sense that animals housed in them became infected, were a myth. Contact with animals with natural or inoculated cancer did not increase the liability to the development of the disease.

A considerable part of the report was devoted to the discussion of the question of "cancer houses." Five of the best known instances of cancer houses had been inquired into and the places visited. Inquiries had also been instituted into a sixth area, which had also been visited. The investigations into "cancer houses" and "cancer areas" accorded with what had been established by experiments on animals. "Cancer houses" were as much a myth as were "cancer cages."

INTERNATIONAL COMMISSION ON THE CHEMICAL ANALYSIS OF SOILS.

A MEETING of the International Commission on the Chemical Analysis of Soils was held at the Forestry Research Station, Munich, on April 23–24. Prof. Kraus, of the agricultural department of the Technical Highschool, Munich, was elected chairman.

The first discussion, on the "Preparation of Soil Extracts for Total Analysis," was opened by Dr. A. von Sigmond (Budapest), who had prepared an exhaustive account of previous discussions on the subject at earlier meetings of the commission. The account is published in the *Internationale Mitteilungen für Bodenkunde*, 1914, and includes, in addition to the opinions of von Sigmond himself, articles by Dr. D. J. Hissink, Wageningen; Prof. E. W. Hilgard, Berkeley, California; and Prof. E. A. Mitscherlich, Königsberg. The discussion centred round the relative merits of :—(1) *Hilgard's Method*, digestion of the soil for 120 hours with HCl of 1·115 sp. gr. on a water-bath; (2) *van Bemmelen's Method*, division of the soil into two parts according to their solubility in HCl and H_2SO_4; (3) *Ultimate Analysis* (*Bauschanalyse*) by fusion with alkali, or treatment with HF.

Hissink objected to Hilgard's use of 1·115 HCl, and produced a "boiling-point" curve for HCl of varying strength to show that Hilgard's acid could not have the maximum solvent action, but that it lay with a rather stronger acid which had a higher boiling point. He gave the following results :—

Sp. gr. of HCl		1·115	1·16	1·19
Dissolved Al_2O_3	...	11·7	12·0	12·1
,, Fe_2O_3	...	11·7	11·6	11·7
,, SiO_2	...	25·1	25·6	25·3
,, K_2O	...	1·56	1·51	1·52

and recommended van Bemmelen's method as being the most complete for soil constituents likely to become available for plant food.

Prof. A. Rindell (Helsingfors) gave results of estimations of K_2O in felspar using varying proportions of felspar to acid :—

Felspar gr./litre	K_2O gr./litre	Per cent. of K_2O
50 ...	0·144 ...	0·288
100 ...	0·258 ...	0·258
200 ...	0·511 ...	0·256
300 ...	1·034 ...	0·207

He recommended the "ultimate analysis" as the only one likely to give comparable results for all soils.

Mitscherlich regards no method of strong acid extraction as valuable on the ground that the solution is affected by too many variables.

The position was summed up by Prof. Ramann (Munich), who spoke in favour of much quicker methods, *i.e.* a shorter digestion with HCl, designed not to give a full analysis of all soil constituents, but of the more easily decomposable substances which may within a relatively short period become available as plant food. He contended that such analyses taken in conjunction with others, such as the estimation of easily soluble constituents, the mechanical analysis, etc., would for all soils of the same type give accurately comparable results.

The members of the commission finally decided to unite in their efforts to obtain a standard method, and to investigate thoroughly the different methods side by side for their particular types of soils.

The next discussion, led by Mitscherlich and Ramann, dealt with the "Estimation of the Easily Soluble Soil Constituents." Mitscherlich advocated his well-known method of extraction with water saturated with CO_2, the temperature, time of extraction, quantities of water used, etc., all being constant during the extraction and for all soils. Ramann outlined a new and interesting method recently tried by him, but not yet thoroughly worked out in detail.

The water-containing double silicates of the soil can be separated into two groups: (1) those which permit of a quick, almost instantaneous replacement of their bases; (2) those with which the replacement of their bases takes place only very slowly. The bases from group (1) can be completely removed from a soil by the action of a fairly strong (10 per cent.) solution of an electrolyte, provided that the experiment is so arranged, that the soil is continually in contact with the fresh solution, or, in other words, that the dissolved bases are immediately removed. This is carried out by allowing the electrolyte solution to filter slowly through a column of soil in a vertical glass tube. Ramann found that by taking 25 grams of soil and a 10 per cent. solution of ammonium nitrate the whole of the easily replaceable bases of group (1) was contained in the first 50 c.c. of the filtrate. The following quantities of 50 c.c. contain a very small proportion of replaced bases, the quantity of which represents the equilibrium between electrolyte solution and the silicates of group (2). For example, the proportions of CaO, MgO, K_2O, Na_2O obtained in the first, second, third, fourth, and fifth 50 c.c. of filtrate for 25 grams of soil were as follows :—

Order of filtrate (50 c.c. to each)	1st	2nd	3rd	4th	5th
CaO ...	0·403	0·029	0·049	0·042	0·030
MgO ...	0·076	0·002	0·009	0·008	0·004
K_2O ...	0·013	0·002	0·004	0·002	0·003
Na_2O ...	0·012	0·003	0·005	0·003	0·002

Ramann is of the opinion that these easily replaceable bases represent the bulk of the available mineral matter in soils, and therefore proposes that this should be estimated.

To obtain further information as to the bases in soils most easily attacked and set free by weak acids, and as to the easily soluble P_2O_5, Ramann makes use of water containing CO_2. The extraction is carried out in a large Soxhlet extractor; the water is boiled and condensed in the usual way, and the CO_2 is led directly into the thimble containing the soil. The stream of CO_2 is constant, the temperature is kept as constant as possible (between 60° and 70° C.), and the burner arranged so that the syphon works every 90 minutes. The extraction continues for ten hours, when practically all solvent action has ceased. Ramann recommends that the two estimations should be made simultaneously.

These methods called forth such universal interest that practically all members took part in the discussion following, and unanimously requested a demonstration of the methods, which was given at the end of the conference in Ramann's laboratory. The remarkable part of the discussion was that no method involving the use of organic acids, such as citric acid, was even mentioned. The methods of Hall and Dyer, and the American official method, used almost exclusively in England and America respectively, appear to be very little used on the Continent.

It was unanimously decided that for the purposes of the commission, *i.e.* the arrangement of standard international methods of soil analysis, members should for the present confine their work to extractions with water and CO_2.

The discussion on methods for the "Estimation of Acidity in Soils" was opened by Dr. Gully, of the Research Station for Moor Cultivation in Munich. He gave an account of the methods tried in his

laboratory for the estimation of acidity in peats from different types of moors. The most satisfactory results were obtained by treatment of the peat with calcium acetate and estimation of the free acid resulting.

Dr. Tacke (Bremen) supported the method adopted at Bremen, *i.e.* neutralisation with $CaCO_3$, on the ground that it involves the actual practical method of getting rid of acidity in moors. Moreover, whether the acid properties are due to the presence of actual acids or to colloids, $CaCO_3$ is the best and most commonly applied neutraliser.

Tacke's method found many supporters who frequently use it and have always found it efficient. Results obtained at Bremen with the two methods, $CaCO_3$ and calcium acetate, agreed very well. It became at once noticeable that the former diversity of opinions between the stations at Bremen and Munich, as to the nature of soil acidity, no longer exists to the same extent. It appears to be generally accepted that the acidity of sour soils may be due to the presence of both actual acids and colloids. Tacke still maintains that the fact that most colloids present in soils are acid is sufficient to account for the views previously put forward by Baumann and Gully.

The discussion was chiefly remarkable for bringing out the large number of methods which have been employed by different workers. These included the direct method of obtaining an alkali extract, precipitating the brown colloidal matter with neutral calcium chloride, and titrating the clear solution. Another method was the estimation of the H ions in a water extract. It was considered that much more research is required before any particular method can be adopted officially.

A committee, consisting of Prof. Albert, Prof. Rindell, Dr. Tacke, and Dr. Gully was appointed to test thoroughly the different methods.

After the meeting the members of the commission were conducted by Prof. Kraus through an interesting collection of soils in his laboratory, including typical agricultural soils of Bavaria and other German States and also a large collection from the German colony of Togo; then by Prof. Henkel through the other laboratories of the agricultural section of the Munich Technical High School. J. A. H.

THE STARS AROUND THE NORTH POLE.[1]

THIS is a mathematical problem which can be solved fairly easily, and the answer is that the stars must be distributed in distance according to a law shown graphically by the curve in Fig. IV. (The distribution of velocities $\frac{h}{\sqrt{\pi}}e^{-h^2v^2}dv$ combined with the distribution of proper motions $\frac{dr}{a}\left(1+\frac{r^2}{a^2}\right)^{-\frac{3}{2}}$ leads to the patial distribution $2a^2h^2re^{-a^2h^2r^2}dr$).

In the diagram, distances are measured horizontally, the unit of distance being that at which a star's parallax is equal to $1''$ (or 206,265 times the distance of the earth from the sun). It is convenient to have a name for this unit, and in what follows the word *Parsec*, suggested by Prof. Turner, will be adopted. With this unit a distance of 100 in the diagram denotes twenty million times the distance of the sun from the earth. The following table gives the percentage of stars between certain limits of distance:—

TABLE IV.

6	per cent.	of the stars	are	between	0 and 100	parsecs
5	,,	,,	,,	100	,, 200	,,
10	,,	,,	,,	200	,, 400	,,
43	,,	,,	,,	400	,, 700	,,
36	,,	,,	,,		>700	,,

It follows that 88 per cent. of the stars in Carrington's Catalogue—that is, 88 per cent. of all the stars brighter than about 10·5 magnitude—lie between 20 and 150 million times the distance of the sun from the earth. This law of the distribution of the stars is at first sight rather surprising. It should be remembered that the only stars at a great distance which are included are those which are intrinsically very bright, and these form only a small proportion of all the stars. Prof. Eddington has found that a similar law holds for stars brighter than 6·0 magnitude.

Having found the law of distribution of the distances of these stars, it is not difficult to determine something about their absolute luminosities, *i.e.* how they would compare with the sun in brightness if placed at an equal distance from us.

If the sun were at a distance of one *parsec*, it would appear as a bright star, brighter than the first magnitude—actually of magnitude 0·5; if at a distance of 100 parsecs, its magnitude would be 10·5. Now all the stars in Carrington's Catalogue may be taken as brighter than 10·5 magnitude, thus at least 95 per cent. of these stars are intrinsically brighter than the sun, and at least 80 per cent. are four times as bright, 40 per cent. are sixteen times as bright, and 8 per cent. are fifty times as bright.

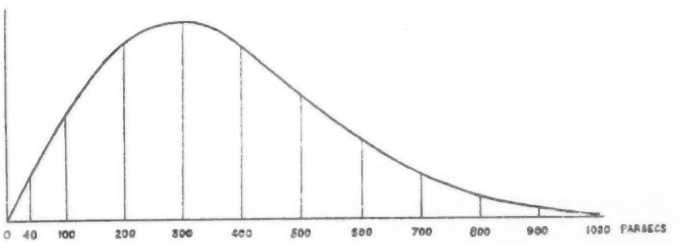


FIG. 4.—Distribution in distance of the stars in Carrington's Catalogue.

We may conclude that the great majority of the stars brighter than 10·5 magnitude are intrinsically brighter than the sun, and a considerable proportion very much brighter.

The distribution of bright and faint stars in a given volume of space is quite different, and contains a much larger proportion of faint stars. If we make the assumptions that the density of the stars and the proportions of bright and faint ones is the same at the different distances from the sun within which these Carrington stars are situated, it is possible to find the actual number of stars of different luminosities in a given volume of space. In a sphere with radius 100 parsecs, or twenty million times the distance of the earth from the sun, there are, at least,

24	which are	100	times as luminous as	the	sun
340	,,	50	,, ,,	,,	
1,530	,,	25	,, ,,	,,	
4,840	,,	10	,, ,,	,,	
23,200	,,	1	,, ,,	,,	
93,300	,,	$\frac{1}{10}$th the luminosity of the sun.			

[1] Discourse delivered at the Royal Institution on Friday, April 24, by Dr. F. W. Dyson, F.R.S. Continued from p. 576.

The data only admit of a rough determination of the number of very faint stars and the number of very bright ones. The figures give a general indication of the density of the stars in space and of their intrinsic brightness, and serve to direct attention to the fact that there are many stars much less luminous than the sun, and a certain proportion very much more luminous.

The conclusions drawn up to this point have been based entirely on a consideration of the proper motions of the stars, irrespective of whether they are bright or faint, provided only that they are sufficiently bright to have been observed by Carrington. But as the apparent magnitude of a star depends on its distance as well as on its intrinsic brightness, we naturally expect some assistance in assigning the distances of these stars from their magnitudes. The brightest star in this small area round the North Pole is Polaris, the magnitude of which is 2. (It may be remarked incidentally that the distance of the pole star has been actually measured. It is twenty parsecs, or four million times the distance of the sun from the earth, and if it were at the same distance as the sun it would appear to be 100 times as bright.) Then there are about twenty stars which are visible to the naked eye. The following table gives the actual number of stars of different magnitudes (photographic):—

TABLE V.

Brighter than	7·0m.	61 stars
From 7·0m. to	8·0m.	124 „
„ 8·0m. „	9·0m.	397 „
„ 9·0m. „	10·0m.	998 „
Fainter than	10·0m.	2140 „

Then, again, the stars may be divided into groups according to the physical characteristics revealed by the spectroscope. The researches of Kapteyn, Campbell, and others have shown—at any rate, for the brighter stars—remarkable relationships between the distances and velocities of the stars and the type of spectrum which they manifest. It is therefore desirable to examine the proper motions of stars of different spectral types separately. The spectra of many thousands of stars have been determined at Harvard College, under Prof. Pickering's direction, by Miss Cannon. The different classes are indicated in the Harvard classification by the letters B, A, F, G, K, M, with further subdivisions. The B stars are characterised by the presence of helium, the A stars by series of broad hydrogen lines. In the F stars the hydrogen lines are thinner, and fine metallic lines are shown. The G stars are very like the sun, full of metallic lines, and with broad lines due to calcium. In the K stars the two calcium lines are still broader, and there are many fine metallic lines. The M stars are characterised by broad absorption bands. This arrangement places the stars in the order of their temperatures; the B stars are the bluest and hottest, and the M stars the reddest and coolest. The character of the spectra of about 800 of the stars in Carrington's Catalogue is given by the Harvard observations.

For the fainter stars the spectra have not been determined, but they can be inferred in another way. As the blue stars are more active photographically than the red stars, if a red and a blue star have the same visual magnitude, the magnitudes estimated from the images on a photograph will differ considerably, and this difference is an index of the colour, and thus of the type of spectrum. Now the visual magnitudes of most of these faint stars have been very accurately determined at Potsdam by Messrs. Müller and Kron (and have been kindly communicated in manuscript), and the photographic magnitudes have been determined at Greenwich. The differences have been taken between the photographic and visual magnitudes, and serve to classify the stars according to their temperature.

Separating the stars into two groups, those which are brighter than 9·5 magnitude on the Potsdam scale of magnitudes, and those which are fainter than 9·5 magnitude, and dividing each group into four classes according to the colour index, the parallactic motion, *i.e.* the mean angular movement per century arising from the motion of the sun through space, is determined for each class. The results are exhibited in the following table:—

TABLE VI.

Spectral class	Colour index	Stars brighter than 9·5m. Number	Stars brighter than 9·5m. Parallactic motion	Stars fainter than 9·5m. Number	Stars fainter than 9·5m. Parallactic motion
			″		″
K—M	>8	175	0·65	269	0·36
G—K	4 to 8	168	1·31	428	0·95
F—G	−1 to 4	264	2·58	959	1·53
A—F	<−1	240	1·97	460	1·28

In this table the red stars are on the top line; the third line consists of stars which are in the same stage of development as the sun; those in the second line are somewhat cooler and redder; those in the last line hotter and bluer. The last line includes a few, but only a few, B stars, as there are not many in this part of the sky. The quantities in the fourth and six columns of the table are a gauge of the distance of the stars to which they refer. It is only necessary to divide these into 337″, which is the angle through which a star distant 1 parsec would have been displaced in the solar motion in one hundred years, to obtain the distances in parsecs. Thus the 240 stars belonging to types A–F, and brighter than 9·5 magnitude, are at an average distance of 170 parsecs.

The first point to notice is that parallactic motions of stars fainter than 9·5 magnitude are always considerably less than the corresponding quantities for stars brighter than 9·5 magnitude. This is, of course, because the faint stars are, on the whole, further away. The average distance of stars of magnitude 10·0 is approximately $1\frac{3}{4}$ times as great as for a star of 8·0 magnitude.

The next point is the very great distance of the red stars. The 269 faint red stars are very nearly 1000 parsecs away, or 200 million times as distant as the sun. At this great distance the sun would appear as of magnitude 15·5, but these stars vary in magnitude from 9·5 to 11·0, and are therefore intrinsically from 250 to 63 times as bright as the sun. Now it happens that among the stars nearest to the sun the distances of which have been actually measured there are several red stars, and these are all very much fainter than the sun. It has been suggested by Prof. Russell and Prof. Hertzsprung independently that the red stars are of two distinct classes, which they call the giants and the dwarfs, and that, in accordance with Sir Norman Lockyer's views, the giant red stars are in an early stage of evolution, and are increasing in temperature; while the dwarf stars are at the other end of the series, and are growing colder and darker.

Leaving the red stars, it is seen that the stars the colour indexes of which lie between −1 and +4 are nearer to us than the groups on either side of them. These stars are those the spectra of which are of the types F and G in the Harvard notation, and are the stars most like the sun. The mean distances of these stars is only 130 parsecs for the stars brighter than 9·5 magnitude, and 215 parsecs for the stars fainter than 9·5 magnitude. At this distance the sun would be of magnitude 12·1. It

follows that these stars are, on the average, from two to eight times as bright as the sun. The A–F stars are a little, but not much, further away, the stars fainter than 9·5 magnitude being at an average distance of 263 parsecs. At this distance the sun would have a magnitude of 12·5, and these stars are from sixteen to four times as luminous as the sun.

It has been shown how the knowledge that the solar system is moving in a known direction with a velocity of 19·5 km. per second leads to a determination of the distances of groups of stars the angular movements of which are known. The hypothesis made is that in a number like one hundred or two hundred stars, the irregular angular movements due to the motions of the stars themselves neutralise one another on the average. But this is only the mean distance of the group, and some are much nearer and some much further. The distribution of the stars about this mean distance may be derived from the proper motions, if we know how the linear velocities are distributed. I shall apply this method to the group of stars which are like the sun in type of spectrum, and therefore, presumably, of like temperature and physical constitution.

Dividing these into three classes according to their magnitude, it is found that their parallactic motion due to the sun's movement, and their average motion in the perpendicular direction due to their own peculiar movements, are as follows :—

	No.	Parallactic motion	Av. cross motion	Ratio
		″	″	
All stars down to 11·0m.	1247	1·92	±1·67	0·87
Stars brighter than 10·0m.	470	2·50	±2·10	0·84
" " 9·0m.	148	3·34	±2·90	0·87

In the last column is given the ratio of the average cross motion to the parallactic motion. The agreement of the numbers shows that the bright stars and the faint stars have the same average velocity. Taking the velocity of the sun as 19·5 km. a second, it follows that the average velocity of these stars in the direction perpendicular to the sun's motion is 13·7 km. a second.

We shall now make the assumption that some of these stars are moving faster than this velocity and some slower, just as errors of observation are distributed about a mean error. With a mean velocity of 13·7 km. a second, there will be in 1000 stars

231	with velocities	0 to	5 km/sec.
208	" "	5 "	10
175	" "	10 "	15
141	" "	15 "	20
163	" "	20 "	30
59	" "	30 "	40
18	" "	40 "	50
1	" "		>50

If now the observed proper motions are arranged, it is found that the number less than any value τ can be represented satisfactorily by an algebraic formula $N\frac{\tau}{(\tau^2+a^2)^{\frac{1}{2}}}$, where N is the total number of stars and a is the mean value of τ. The following table shows the actual number of stars with proper motions between certain limits, compared with the number given by the formula :—

TABLE VII.

Limits of proper motion	No. of stars observed	No. given by formula	Difference
0″ to 1″ a century	427	429	−2
1 " 2 "	346	337	+9
2 " 4 "	324	332	−8
4 " 7 "	105	103	+2
7 " 10 "	25	22	+3
>10 "	20	19	+1

We may take it that the formula substantially represents the observed facts. With the proper motions distributed according to this formula, and the actual velocities distributed according to the law of errors, the distribution of the stars in distance can be determined, and it is found that these 1247 stars are distributed in space as shown in Table VIII.

TABLE VIII.—*Number of Solar Stars (Types F and G) at Different Distances.*

Distance (parsecs)	Out of total 1247 stars	Out of 470 stars brighter than 10·0m.	Out of 148 stars brighter than 9·0m.
<100	121	76	40
100—200	298	161	65
200—300	332	136	34
300—400	254	68	8
400—500	146	23	1
500—600	65	5	
600—700	23		
>700	5		

The most remarkable feature of this table is that 70 per cent. of the stars lie between the narrow limits of one hundred and four hundred parsecs.

I have treated the 470 stars which are brighter than 10·0 magnitude and the 148 brighter than 9·0 magnitude in a similar manner. The results are given in the third and fourth columns of Table VIII. Taking the differences, the distribution in distance of the 777 stars of magnitude 10·0–11·0 and of the 322 stars of 9·0–10·0 magnitude is found.

To compare the intrinsic magnitudes of the stars it is convenient to take limits of distance in geometrical progression with a common ratio 1·259 (log=0·1), *e.g.* 40, 50, 63, 79, 100, 126, etc., parsecs. These limits correspond to a change of half a magnitude in the intrinsic brightness of the stars which are of the same apparent brightness. Confining our attention to the stars of apparent magnitude 10·0 to 11·0, or, speaking broadly, stars of 10·5 magnitude, the limits 50–63 parsecs contain stars half a magnitude brighter, and distributed over twice the volume of those contained between the limits 40–50 parsecs.

If we may assume that the actual density of the stars is the same in all parts of the space with which we are dealing, we obtain by reasoning of this kind the number of stars between different limits of absolute brightness. The following table shows the number of stars of different luminosities in a sphere of one hundred parsecs radius :—

Luminosity ⊙=1	No. of stars 10·0m.—11·0m.	9·0m —10·0m.
0·40 to 1·0	16,000	18,000
1·0 " 2·5	9,500	11,200
2·5 " 6·3	5,750	7,300
6·3 " 16	2,570	3,600
16 " 40	502	1,040
Brighter than 40	14	68

The results in the second column have been obtained by considering the faintest stars, those from 10·0 to 11·0 magnitude. If the class brighter is taken, those stars which appear to be of magnitudes 9·0 to 10·0, we find in a similar way the quantities given in the last column.

There is an increasing divergence between the results. Now it is to be remembered that these figures have been derived from regions at different distances from the sun. Thus the stars which are between sixteen and forty times the brightness of the sun, and which are apparently of magnitude 10 to 11, lie between 398 and 631 parsecs, while those which are apparently of 9·0 to 10·0 magnitude lie between 251 and 398 parsecs.

We may conclude, therefore, that the density of

this class of stars is somewhat less at this greater distance from the sun. Following out this line of reasoning, I have found that the diminution of density of the stars to be as follows :—

Distance	Density	Distance	Density
At 50 parsecs	1·30	At 300 parsecs	0·48
100 ,,	1·00	400 ,,	0·32
200 ,,	0·70	500 ,,	0·21

Although much weight cannot be attached to the exact figures, one seems justified in saying that there must be a very considerable falling off in the density of the stars between the distances of one hundred and five hundred parsecs. A falling off in the total density of the stars would affect the tables giving the proportion of stars of different brightness, and would increase considerably the proportion of bright stars.

Although the conclusions presented in this paper have been derived from a study of the proper motions of the stars in a small area of the sky, and may be somewhat modified by the investigation of other regions, they may be considered as fairly applicable to the stars in general. The limiting magnitude of the stars that have been considered is nearly 11·0 (on the Potsdam scale), and there are, in the whole sky, half a million stars brighter than this limit of magnitude.

It may be said of them that :—

(i) On the whole, the yellow stars, the stars like the sun in physical conditions, are the nearest.

(ii) They lie within fairly narrow limits of distance—80 per cent. are between one hundred and five hundred parsecs, 10 per cent. nearer than one hundred parsecs, and 10 per cent. further away than five hundred parsecs.

(iii) Going from the yellow to the blue or the orange stars, the average distances increase.

(iv) The red stars are at great distances—an average of about one thousand parsecs.

(v) The stars vary greatly in *intrinsic brightness*. The red stars are specially luminous, being on an average one hundred times as bright as the sun.

(vi) Considering all the stars down to this limit of magnitude, from 90 to 95 per cent. are intrinsically more luminous than the sun.

(vii) When, however, the luminosity of the stars in a given volume of space is considered, there are found to be far more faint than bright stars. There is no contradiction between this conclusion and the last one, because the more distant bright stars are visible, while we only see the faint ones which are comparatively near.

(viii) Evidence has been found that the stars thin out very materially at great distances from the sun.

These conclusions are in harmony with the conception of a finite stellar universe. Most of the stars we see, and a great many fainter ones, are within the distance of one thousand parsecs. Doubtless the stars extend to much greater distances, perhaps ten times as far or further, but we can scarcely doubt that we are near the middle of a finite group of stars, and that the extent of this group is of the order of one thousand to ten thousand parsecs.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—Two lectures on studies in historic magnetism will be given in the autumn by Prof. S. P. Thompson.

The Rogers prize has not been awarded this year. It will be again offered for award in 1916, and the subject of the essay or dissertation will again be "The Nature of Pyrexia and its Relation to Micro-organisms."

Applications are invited from suitably qualified biologists wishing to engage in research work for the use of the University table at the laboratory of the Marine Biological Association at Plymouth. Preference will be given to members of the University of London. Applications should be sent to the secretary of the Board of Studies in Zoology, the University of London, South Kensington, S.W., and should be accompanied by a statement of the qualifications of the candidate and a brief account of the investigation which he proposes to undertake.

LONDON (UNIVERSITY COLLEGE).—The Drapers' Company has made a grant of 500*l.* a year for three years, in aid of the work of the department of applied statistics, including the Galton Laboratory of Eugenics and the Drapers' Biometric Laboratory.

THE Russian Imperial Duma has voted in favour of the proposal to establish a faculty of medicine in the University of St. Petersburg.

THE Hele-Shaw prizes in the faculty of engineering of the University of Bristol have been awarded as follows : to Mr. John Rogers (a day student) and Mr. Arthur George Adams (an evening student).

THE trustrees of the University of Pennsylvania have sanctioned the admission of women to the medical college of the University. The new regulations will come into force in the autumn of the present year.

ACCORDING to a Reuter telegram honorary degrees have been conferred upon the following members of the British Association by the University of Perth, Western Australia :—Prof. W. Bateson, Prof. Herdman, Dr. A. D. Waller, and Dr. A. C. Haddon.

THE twenty-fifth anniversary of the opening of the Johns Hopkins Hospital will be celebrated in October next. The celebration will begin on October 5 with a meeting to be presided over by Dr. W. H. Welch, at which Prof. Sir William Osler will speak. On October 7 the new Brady Urological Institute will be dedicated.

THE Board of Education has issued [Cd. 7531] the regulations for technical schools, schools of art, and other forms of provision of further education in England and Wales which came into force on August 1. This year the Board has included in the same volume with the regulations for evening schools, day courses in technical institutions and schools of art, the regulations for junior technical schools and those for university tutorial classes. No changes of substance are made in the regulations for junior technical schools or in those for university tutorial classes. Other alterations, which are not numerous, are printed in distinctive type so as to make reference and comparison easy.

THE annual examinations of the National Agricultural Examination Board in the science and practice in dairying will be held for English students on September 12, and following days, at the University College and British Dairy Institute, Reading, and for Scottish students on September 19 and following days at the Dairy School, Kilmarnock. All candidates must have spent at least four months on a dairy farm, and present certificates from approved institutions testifying (1) that he or she has received at least six months' instruction in practical dairy work, and (2) that he or she has attended approved courses in chemistry, bacteriology, and botany, and has satisfied the authorities of the institution of his or her fitness for admission to the examination. Entry forms and all further particulars may be obtained from the Royal Agricultural Society of England, 16 Bedford Square,

W.C., or the Highland and Agricultural Society of Scotland, 3 George IV. Bridge, Edinburgh. The latest date for receiving applications is August 15.

SIR J. J. THOMSON delivered the inaugural lecture at the summer meeting of the Cambridge Local Lectures on Friday last, taking as his subject, "Education and Science." Referring to the changes in the educational system, he said that visitors to Cambridge thirty or forty years ago used to get confused by the multitude of colleges, but the very small number of laboratories gave them no trouble. Now there were quite as many laboratories as colleges, and they would realise the liberality with which the ancient University had welcomed these modern studies. It had also made no distinction in its award of fellowships and scholarships between the old studies and the new, and had acted on the principle that its duty was to take all knowledge as its province. As one whose work had been for the most part connected with the newer studies, he was pleased to have the opportunity of acknowledging the liberality and sympathy which those studies had received at Cambridge. The progress of science had been hastened by the additional facilities provided for research in recent years. And if it was a fact that the application of science to the prevention and cure of disease, to the increase in facilities of transport, of intercourse, and of the amenities of life had been a gain to humanity, had increased human happiness, and diminished human suffering, then it was the bounden duty of every civilised nation or community to do all in its power to hasten that progress. Humanity was suffering from evils which could be cured more quickly if still greater resources were placed at the disposal of scientific workers. It would be unfair and ungrateful not to acknowledge that the Government, without any pressure from public opinion, had done something in that direction, but much remained to be done. When the people of this country realised that some of the evils from which they were suffering would be removed some day or other by science they would insist that the pace should be hastened as much as possible.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 20.—M. P. Appell in the chair.—Paul **Sabatier** and A. **Mailhe**: The catalytic decomposition of benzoic acid. A study of the action of various catalysts upon the vapour of benzoic acid at 550° C. With the blue oxides of tungsten and molybdenum and the oxides of zirconium and cerium the acid passes unchanged. Benzene and carbon dioxide are produced in presence of reduced copper, cadmium oxide, zinc oxide, and titanium oxide. Benzophenone is the main reaction product in presence of lithium and calcium carbonates.—H. **Douvillé**: The first geological epochs. A discussion of the composition of the earth's atmosphere at varying temperatures of the earth's crust, with especial reference to the conditions prevailing at temperatures between 700° C. and 364° C.—Y. **Delage**: The capture of a specimen of *Luvarus imperialis* on the coast of Finistère.—A. **Blondel**: Electric chronographs and self-recording micro-galvanometers. Remarks on an instrument recently described by M. Beauvais, and referring to earlier communications by the author describing a similar instrument.—Ph. A. **Guye** and F. E. E. **Germann**: The gases retained by iodine and by silver. An application of the apparatus recently described by the authors for the analysis of minute volumes of gas. The gas contained in the silver was determined by conversion into iodide in a vacuum, and the gases evolved pumped out and analysed. Oxygen, carbon monoxide, and water vapour were found.—Kr. **Birkeland**: The zodiacal light. A discussion of some recent observations from the point of view of the author's hypothesis, that the sun emits radiant matter and electrons, and that these corpuscles group themselves round the magnetic solar equator.—S. **Stoïlow**: The integrals of partial differential linear equations with two independent variables.—Pierre **Sève**: The use of an alternating current for the transmission of the indications of apparatus of which the index can effect complete rotations. Application to the distribution of time.—G. **Chaudron**: The reversible reactions of water on iron and on ferrous oxide. From the experiments quoted the author concludes that between 300° C. and 1000° C. there are two series of equilibria with the solid phases iron-ferrous oxide, iron-magnetic iron oxide.—M. **Delépine**: The separation of the optical isomerides of the iridotrioxalates.—F. **Taboury**: Contribution to the study of the iron-zinc alloys. The crystals formed in baths used for galvanising iron contain a constant proportion (7·3 per cent.) of zinc.—A. **Sénéchal**: The solid chromic sulphates.—H. **Giran**: Bromine hydrate. From a cryoscopic study of mixtures of bromine and water, Br_2+8H_2O is deduced as the composition of the hydrate.—Th. W. **Richards** and M. E. **Lembert**: The atomic weight of lead of radioactive origin. According to the theory of Soddy and Fajans, the atomic weight of lead derived from the decomposition of radium and uranium should be 206·0, that from thorium, 208·4, ordinary lead being 207·1. Experiments with lead from carnotite gave 206·59, from three samples of pitchblende, 206·57, 206·40, and 206·86, one from thorianite, 206·82.—A. **Desgrez** and R. **Moog**: A method for the estimation of urea. Details of a method based on the decomposition of urea by Millon's reagent, in presence of infusorial earth. Test figures showing the accuracy obtainable are given.—R. **Fosse**: The gravimetric quantitative analysis of small quantities of urea for dilutions greater than 0·1 per cent. The urea is weighed as an insoluble compound with xanthydrol.—H. **Gault**: Oxalocitric lactone and its transformation into tricarballylic acid. The best yield of tricarballylic acid from oxalocitric lactone is obtained by heating the latter with alcohol to 180° C.—Albert **Gascard**: The presence of an alcohol and an acid, both containing thirty-two atoms of carbon, in the wax of *Tachardia lacca*.—A. **Dufflour**: An association of crystals of unequal symmetry.—C. **Gaudefroy**: The dehydration of gypsum.—J. **Deprat**: The projects for the Yun-nan-fou railway at Sseutchoan and their relations with geology. From the geological point of view it is shown that the construction of the proposed line would offer great difficulties, and the upkeep would be onerous and costly. From an economic point of view the line would probably prove unprofitable.—V. **Vermorel** and E. **Dantony**: The chemical composition of alkaline spraying mixtures and the soluble copper which they contain. Alkaline Bordeaux mixtures, contrary to the view currently held, contain copper in the dissolved state.—F. **Jadin** and A. **Astruc**: Arsenic and manganese in some plant products used for animal food. Arsenic and manganese are shown to be present in fifteen plant products, and are probably normal constituents of the plant cell.—P. **Mazé**: The mechanism of the exchanges between the plant and the external medium.—J. **Giaja**: Study of reactions of two ferments working together. The hydrolysis of amygdalin by emulsin, or by the digestive fluid of *Helix pomatia*, is shown to be the result of two connected fermentative actions, involving the production of reducing sugar and hydrocyanic acid respectively.—Mme. Marie **Phisalix**: The action of the virus of hydrophobia on Batrachians and

snakes.—Pierre **Delbet** and Armand **Beauvy**: Comparative study of the action of ultra-violet light on the hæmolytic power and the colloidal state of blood serum.—Henri **Piéron**: The influence of the state of adaptation of the eye on the laws of decrease of the time of latency for various light radiations.—C. **Levaditi**: Hydrophobia virus and cells cultivated *in vitro*.—G. **Marinesco** and J. **Minea**: The infective power of the cephalo-rachidian fluid in juvenile general paralysis. This fluid has been shown to contain living spirillæ.

BOOKS RECEIVED.

The Commonwealth of Australia. Federal Handbook, Prepared in Connection with the Eighty-fourth Meeting of the British Association for the Advancement of Science, held in Australia, August, 1914. Edited by G. H. Knibbs. Pp. xvi+598. (Melbourne: A. J. Mullet.)

Geologischer Führer durch die Lausitz. By P. J. Beger. Pp. xii+319. (Berlin: Gebrüder Borntraeger.) 6 marks.

Astronomy. By C. Flammarion. Pp. xi+191. (London: Constable and Co., Ltd.) 2*s*. net.

The English Year. Summer. By W. B. Thomas and A. K. Collett. Pp. viii+341+plates. (London and Edinburgh: T. C. and E. C. Jack.) 10*s*. 6*d*. net.

Memoirs and Proceedings of the Manchester Literary and Philosophical Society, 1913–14. Vol. lviii., part ii. (Manchester.) 7*s*.

Dante and the Early Astronomers. By M. A. Orr. Pp. xvi+507. (London and Edinburgh: Gall and Inglis.) 15*s*. net.

Proceedings of the Royal Irish Academy. Vol. xxxi. Clare Island Survey. Part 7, Geology. By T. Hallissy. Pp. 22+vi plates+1 map. 1*s*. 6*d*. Part 9, Tree Growth. By A. O. Forbes. Pp. 32+ii plates. 1*s*. Part 47, Archiannelida and Polychæta. By R. Southern. Pp. 160+xv plates. 5*s*. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate.)

The Khasis. By Lt.-Col. P. R. T. Gurdon. Second edition. Pp. xxiv+232. (London: Macmillan and Co., Ltd.) 10*s*. net.

Enquèttes et Documents relatifs à l'Enseignement Supérieur. cix. Année 1913. Pp. 108. (Paris.)

Ergebnisse der Zweiten Deutschen Zentral-Afrika-Expedition, 1910–11. Under the Direction of Adolf Friedrichs, Herzogs zu Mecklenberg. Band. i., Zoologie. Lief. 4. Pp. 89–108. 90 pfennigs. Lief. 5. Pp. 109–134. 1.20 marks. (Leipzig: Klinkhardt and Biermann.)

Elementary Household Chemistry. By Prof. J. F. Snell. Pp. ix+307. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 5*s*. 6*d*. net.

Glamorganshire. By J. H. Wade. Pp. xi+196. (Cambridge University Press.) 1*s*. 6*d*.

Durham. By W. J. Weston. Pp. viii+184. (Cambridge University Press.) 1*s*. 6*d*.

Flies in Relation to Disease. Non-Bloodsucking Flies. By Dr. G. S. Graham-Smith. Second edition. Pp. xvi+389. (Cambridge University Press.) 12*s*. 6*d*. net.

The Family Chain. Marriage and Relationships of Native Australian Tribes. By J. Hopkins. Pp. 31. (London: Watts and Co.) 1*s*.

Die geologischen Naturdenkmäler des Riesengebirges. By Prof. Dr. Gürich. Pp. 141–324. (Berlin: Gebrüder Borntraeger.) 5.50 marks.

Kräfte und Spannungen das Gravitations- und Strahlenfeld. By Prof. Dr. Max B. Weinstein. Pp. vi+64. (Braunschweig: F. Vieweg und Sohn.) 2 marks.

Verflüssigung der Kohle und Herstellung der Sonnentemperatur. By Prof. Dr. O. Lummer. Pp. xiii+140. (Braunschweig: F. Vieweg und Sohn.) 5 marks.

Malaio-Polynesische Wanderungen. By Dr. G. Friederici. Pp. 37. (Leipzig: Simmel and Co.)

Willkommen in Cambridge. Schlichte Antworten auf kluge Fragen. By Karl Breul. Dritte Auflage. Pp. 40. (Cambridge University Press.) 1*s*. 6*d*. net.

Mellon Institute of Industrial Research and School of Specific Industries. Smoke Investigation. Bulletin No. 8. Some Engineering Phases of Pittsburgh's Smoke Problem. Pp. 193+plates. (Pittsburgh, Pa.: University of Pittsburgh.)

Experimentelle Untersuchungen über die innere Sekretion der Keimdrüsen und deren Beziehung zum Gesamtorganismus. By Dr. W. Harms. Pp. iv+368. (Jena: G. Fischer.) 12 marks.

Deutsches Meteorologisches Jahrbuch für 1913. Freie Hansestadt Bremen. Jahrgang xxiv. Edited by Prof. Grosse. Pp. iv+88. (Bremen: Jilling and Lüken.)

CONTENTS.

	PAGE
The New British Flora. By **A. B. R.**	579
Geographical Guides. By **G. A. J. C.**	580
Genetics	581
Our Bookshelf	582
Letters to the Editor:—	
The Hæmoproteus of the Indian Pigeon.—**Lt.-Col. A. Alcock, C.I.E., F.R.S.**	584
Radio-activity and Atomic Numbers.—**Dr. F. A. Lindemann**	584
Circulatory Movements in Liquids. (*Illustrated.*)—**Prof. D. J. Korteweg**	584
Natural History and the Ocean. (*Illustrated.*)	585
The Administrative Problem of Sleeping Sickness	587
Recent Studies of the Atmosphere	58
Notes	589
Our Astronomical Column:—	
Comet 1913*f* (Delavan)	594
Nebular Rotation	594
Solar Physics Observatory, Cambridge	594
Annals of the Royal Belgium Observatory	594
The Aberdeen Meeting of the British Medical Association	595
The Havre Meeting of the French Association	595
Imperial Cancer Research Fund	597
International Commission on the Chemical Analysis of Soils. By **J. A. H.**	598
The Stars Around the North Pole. (*With Diagrams.*) By **Dr. F. W. Dyson, F.R.S.**	599
University and Educational Intelligence	602
Societies and Academies	603
Books Received	604

Editorial and Publishing Offices:

MACMILLAN & CO., LTD.,

ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.

Telephone Number: GERRARD 8830.